GEOTECHNICAL INVESTIGATION
CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

KLEINFELDER PROJECT # 20150225.002A

May 7, 2015

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May 7, 2015
Project No: 20150225.002A

Santa Clara Valley Water District
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Attention: Karl Neuman, PE, GE
Associate Civil Engineer
(kneuman@valleywater.org)

Subject: **Geotechnical Investigation**
Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

Dear Mr. Neuman:

Submitted herewith is a report of our geotechnical investigation for the Cunningham Flood Detention Facility Existing Levee Evaluation in San Jose, California. Our services are authorized by Task Order No. 2 under the terms of Standard On-Call Consulting Agreement No. A3711A between the Santa Clara Valley Water District and Kleinfelder. This study was conducted in general accordance with our proposal dated September 23, 2014.

Thank you for the opportunity to be of service on this project. Please contact the undersigned at 510-628-9000 if you have any questions regarding this report.

Sincerely,

KLEINFELDER WEST, INC.

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1. INTRODUCTION

This report presents the results of our geotechnical investigation of the existing levees for the Cunningham Flood Detention Facility located in San Jose, California. Our understanding of the project is based on our discussions with Santa Clara Valley Water District (District) representatives and our collaboration with them on the various phases of the project. Discussions of the project and our scope of services are described below.

1.1. PROJECT DESCRIPTION

Lake Cunningham Regional Park is a 202-acre water-oriented park situated in the southeast section of San Jose, just upstream of the District's Lower Silver Creek Flood Protection Project. It is bounded by Capitol Expressway to the west, Cunningham Avenue to the north, White Road to the east, and Tully Road to the south. Lower Silver, Flint, and Ruby Creeks flow along the inner perimeter of the site. The purpose of this project is to conduct a screening-level study that will provide information needed to conduct final investigations and planning for a final study. The purpose of the forthcoming final study will be to certify the Cunningham Flood Detention Facility to ensure the site operates as a flood detention facility providing 100-year flood protection for the area near and north of the park site. The levee system around the park does not fall under the jurisdiction of the U.S. Army Corps of Engineers (USACE) and has not been certified by Federal Emergency Management Agency (FEMA).

The District provided Kleinfelder with geotechnical information prepared by Woodward-Clyde Consultants in 1976 and 1978 that suggests that a large quantity of soil generated by the excavation of the lake was used to build the levees/embankments along the creeks within the park site. The site grading plan, prepared by George S. Nolte & Associates in 1978, shows design elevations and side slope information for the creek channels and for the embankments. As-built grading plans and construction records are not available.

The portion of the perimeter levee system under evaluation by the District is an approximately 6,000-foot long segment along the western, northern and eastern ends of the park, roughly bounded by the points labeled B-1 and B-6 shown on Figure 1, Site Plan. The topographic contours shown on Figure 1 were provided by the District based on a survey dated August,

2012. This portion of the levee near Lower Silver Creek between Tully Road and Cunningham Avenue may be raised by up to 3 feet.

In addition to the existing levee evaluation, the District has identified the need for a floodwall along a reach of Flint Creek between Cunningham Avenue and the park entrance at White Road.

Geotechnical investigations of other levees or berms that surround the park other than the reaches described above are outside the scope of this study.

1.2. PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to explore subsurface conditions within and beneath the existing levee at selected locations and to conduct a screening-phase evaluation of the levee performance in providing protection against an anticipated 100-year flood event. This study is directed toward the following:

- Observe and evaluate the current condition of the existing levees noting areas of distress, cracking or erosion.
- Characterize the existing levee materials including their relative compaction characteristics and suitability for re-use as fill for levee construction.
- Evaluate the compressibility and strength characteristics of the levee foundation materials.
- Conduct preliminary seepage and stability analyses at up to four cross section locations.
- Determine the feasibility of raising the levees up to 3 feet or using alternative flood protection structures.
- Provide recommendations for design-level geotechnical studies, if necessary.

Kleinfelder's scope of services included the following.

- Geologic reconnaissance of the site, including field visits to observe and evaluate the current condition of the existing levees and review of published geologic information.
- Field exploration, including drilling 6 soil borings to depths of 41½ to 44 feet and excavation of 4 test pits along the levee crest to depths of 4 to 5 feet. The borings and

test pits were conducted to explore subsurface conditions and to collect samples for field and laboratory testing.

- Field measurements of existing in-place density and moisture content of levee materials at the test pit locations.
- Laboratory testing of soils obtained from the borings and test pits to assess pertinent engineering properties for use in analyses.
- Evaluation of the soil properties encountered in the levee and foundation materials to conduct engineering evaluations including consolidation settlement, seepage and stability.
- Analyzing the available information to develop conclusions and recommendations. Kleinfelder's scope development and analyses generally follow guidelines established by the Federal Emergency Management Agency (FEMA, 2013) and the California Code of Regulations (2014) for evaluating levee systems that are not subject to U.S. Army Corps of Engineers jurisdiction.
- Preparation of this report.

This is a preliminary screening-level study. Detailed seepage and stability evaluations and alternatives analyses that would be required for FEMA certification are outside the scope of this study. Environmental evaluations and analyses, including hazardous materials evaluations and stormwater pollution plans, are also outside the scope of this study.

1.3. EXISTING GEOTECHNICAL INFORMATION PROVIDED BY THE DISTRICT

To aid in the preparation of the scope of work and subsequent evaluations for this project, the District provided the following geotechnical information:

- Woodward-Clyde Consultants (1976), Preliminary Geotechnical Investigation, Lake Cunningham, San Jose, California, report to George S. Nolte and Associates, dated August 30, 1976.
- Woodward-Clyde Consultants (1978), Geotechnical Investigation, Lake Cunningham, San Jose, California, report to Santa Clara Valley Water District, dated September 8, 1978.

- George S. Nolte and Associates (1978), Grading Plan for Cunningham Park, sheets 18 through 34 of 48 sheets. The drawing package is dated October 6, 1978.

The above-referenced reports and grading plan were produced prior to construction of the perimeter levees and formation of Lake Cunningham. Most of the borings referenced in the 1976 and 1978 reports by Woodward-Clyde Consultants were drilled in the interior of the existing lake and park area.

2. FIELD EXPLORATION

2.1 GENERAL

The field exploration program for this project focused on obtaining the following information: 1) soil classification, 2) soil shear strength, 3) groundwater levels and 4) stratigraphy. Exploration included drilling and sampling of both levee embankment and levee foundation materials. The field exploration program included drilling six soil borings, labeled B-1 through B-6, at the approximate locations shown on the Site Plan, Figure 1. In addition, four test pits, labeled TP-1 through TP-4, were also excavated at the approximate locations shown on Figure 1. A summary of boring and test pit data is provided in Table 2-1. Stationing and elevation information is based on the survey data provided by the District along Lower Silver Creek and Flint Creek. Elevations are estimated to the nearest foot with respect to North American Vertical Datum (NAVD) 1988. All elevation references in this report are based on NAVD88.

Before drilling and test pit excavation, the exploration locations were cleared through Underground Service Alert, and a subcontracted utility locator service was used to mark known existing utilities at each boring location. As indicated on the above-referenced 1978 Nolte grading plans, a Pacific Gas and Electric Company (PG&E) gas line corridor was located along the western side of the site, close to the locations of Borings B-1 and B-2 and Test Pit TP-1.

Table 2-1
Soil Borings and Test Pits for the Existing Levee Evaluation

Exploration Designation	Approximate Station	Other Location Information	Approximate Elevation (feet NAVD)	Date Drilled or Excavated	Depth (feet)
B-1	282+00 Lower Silver Creek	On Inside Maintenance Road, Near Inside Levee Toe	133	11/4/2014	41-½
TP-1	279+00 Lower Silver Creek	Levee Crest	140	11/7/2014	4-½
B-2	275+50 Lower Silver Creek	Levee Crest	136	11/4/2014	41-½
TP-2	270+00 Lower Silver Creek	Levee Crest	136	11/7/2014	4-½
B-3	265+00 Lower Silver Creek	Levee Crest	140	11/5/2014	41-½
TP-3	261+00 Lower Silver Creek	Levee Crest	134	11/7/2014	4-½
B-4	254+00 Lower Silver Creek	Levee Crest	134	11/3/2014	44
TP-4	250+50 Lower Silver Creek	Levee Crest	134	11/7/2014	4-½
B-5	2+00 Flint Creek	Levee Crest	134	11/5/2014	41-½
B-6	12+00 Flint Creek	Levee Crest	134	11/6/2014	41-½

The boring and test pit locations were estimated in the field with respect to existing landmarks. Elevation references in Table 2-1 are based on the elevations provided in the survey cross sections provided by the District.

2.2 DRILLING AND SAMPLING METHODS

The borings were drilled by Exploration Geoservices of San Jose, California using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers and mud-rotary drilling capabilities. The borings were drilled between November 3 and November 6, 2014 at the approximate locations shown on Figure 1.

A Kleinfelder field engineer maintained logs of the borings, visually classified the soils encountered according to the Unified Soil Classification System presented on Plate A-1 in Appendix A, and obtained relatively undisturbed and bulk samples of the subsurface materials. Soil classifications made in the field from samples and auger cuttings were in accordance with ASTM Method D2488. These classifications were re-evaluated in the laboratory after further examination and testing in accordance with ASTM D2487. Sample classifications, blow counts recorded during sampling, and other related information were recorded on the boring logs. A key to the symbols used on the boring logs is presented on Plate A-1. Soil classification terms are defined on Plate A-2. Logs of Borings are presented on Plates A-3 through A-8.

Samples were obtained from the borings using close sampling intervals (about 2 to 3 feet) in the upper 15 to 20 feet and at approximate 5-foot intervals thereafter. Soils were sampled by driving either a 2.5-inch inner diameter (ID) split-barrel (California) sampler or a 1.4-inch ID Standard Penetration Test (SPT) sampler into the soil with a 140-pound automatic-trip hammer free-falling a distance of 30 inches. The California sampler was used with brass liners and is in general conformance with ASTM D3550. The SPT sampler was used without liners and is in general conformance with ASTM D1586.

Blow counts were recorded at 6-inch intervals for each sample attempt and are reported on the boring logs. Blow counts shown on the logs have not been corrected for the effects of overburden pressure, rod length, sampler size, or hammer efficiency. However, sampler size correction factors were applied to estimate the sample apparent density noted on the boring logs. The soil descriptions presented on the boring logs are based on field observations of the samples recovered and on the results of the laboratory testing.

2.3 DEPTH TO WATER MEASUREMENTS

Where encountered, the depth at which groundwater was first noticed during drilling is noted on the boring logs. Groundwater level measurements from the borings are summarized below.

Table 2-2
Groundwater Level Measurements

Boring No.	Ground Surface Elevation (feet)	Groundwater Observations		Measurement Date
		Elevation First Noticed During Drilling (feet)	Elevation at End of Drilling (feet)	
B-1	133	111	120 (13-ft depth)	11/4/2014
B-2	136	111	118.5 (17.5-ft depth)	11/4/2014
B-3	140	111.5	113 (27-ft depth)	11/5/2014
B-4	134	119	119 (15-ft depth)	11/3/2014
B-5	134	109	117 (17-ft depth)	11/5/2014
B-6	134	114	123 (11-ft depth)	11/6/2014

Note that the soil borings and the groundwater observations recorded above were made in early November 2014, prior to the start of significant seasonal rainfall in the region.

2.4 BORING COMPLETION AND ABANDONMENT

Borings were completed by filling from the bottom upward with cement grout through a tremie pipe. We placed the drill cuttings and fluids into steel drums, and we coordinated testing, pick-up and off-site disposal of the drums at the Potrero Hills Landfill in Suisun, California. A copy of the waste manifest for disposal is provided at the back of Appendix A.

2.5 TEST PIT EXCAVATIONS

The test pits were excavated by Extreme Backhoe under subcontract to Kleinfelder using a backhoe equipped with a 24-inch bucket. The test pits were excavated on November 7, 2014 at the approximate locations shown on Plate 1 and as described in Table 2-1 above. The test pit depths did not exceed 5 feet. The test pits were logged by a field engineer, who collected bulk samples of the excavated materials for laboratory testing. Logs of the test pits are provided in Appendix A on Plates A-9 through A-12. Groundwater was not encountered in any of the test pits.

At the bottom of each test pit, in-place measurements of density and moisture content were measured using nuclear density gauge testing methods. The results of the field density and moisture content testing are recorded on the test pit logs and are discussed in Section 5.2.

Following testing and sampling, the test pits were backfilled with excavated materials, tamped using the backhoe bucket for compactive effort, and wheel rolled at the ground surface.

3. LABORATORY TESTING

Geotechnical laboratory testing was directed toward classifying the subsurface soils and assessing their strength characteristics. Our laboratory testing was conducted in general accordance with applicable ASTM test procedures by Cooper Testing Labs, Inc. of Palo Alto, California. Geotechnical laboratory tests are presented in Appendix B. In addition to the Appendix B summary, most of the laboratory test results are displayed on the boring and test pit logs.

Classification tests were conducted to aid in soil classification and to correlate the results of other tests conducted on samples taken from different depths or from different borings. Classification tests included natural water content, Atterberg limits (i.e., liquid and plastic limits) and grain-size (sieve) analyses. The results of the classification tests are recorded on the boring logs and are presented in detail in Appendix B.

Undrained shear strengths of selected cohesive samples were evaluated by unconsolidated-undrained triaxial compression (TXUU) and consolidated-undrained triaxial compression (TXCU) tests. Natural water content and dry unit weight were measured as routine portions of the TXUU and TXCU tests. The results of the strength tests are recorded on the boring logs and are presented graphically in Appendix B.

Compressibility characteristics of the levee embankment foundation soils were evaluated by one-dimensional consolidation tests. Natural water content and dry unit weight were measured as routine portions of the consolidation tests. The results of the consolidation tests are included in Appendix B.

Modified Proctor tests (ASTM D1557 compaction curves) were conducted in the laboratory on bulk soil samples collected from each of the test pits. The maximum dry unit weight and the optimum water content from the Modified Proctor tests are illustrated graphically in Appendix B and are also presented on the test pit logs in Appendix A.

4. GEOLOGY AND SEISMICITY

4.1. AREA AND SITE GEOLOGY

Lake Cunningham Regional Park is located approximately 11 miles southeast of the San Francisco Bay in the western portion of San Jose in Santa Clara County. The majority of this portion of the county contains an alluvial plain that is part of the Santa Clara Valley, a depression filled with Quaternary (between recent and 1.8 million years old [USGS, 2006]) alluvial sediments. The project area is drained by Coyote Creek, a prominent north-flowing drainage course. Other prominent drainage courses, which eventually flow into Coyote Creek, north of Lake Cunningham Regional Park include Thompson Creek and Lower Silver Creek. The San Jose foothills, part of the Diablo Range, border the eastern side of the valley. The geologic structure of the Coast Ranges, which consist of northwest-trending folds and faults, controlled the development of the ridges and intervening valleys of the San Jose foothills (California Geological Survey [CGS], 2000).

Bedrock in the foothills and surrounding areas consists of Mesozoic (between 65 million and 251 million years old) terranes that are overlain by Cenozoic (between recent and 65 million years old) strata on faulted unconformities. The two Mesozoic terranes are the Coast Range Ophiolite, with overlying Great Valley Sequence and the Franciscan Complex. Cenozoic units include marine and non-marine deposits ranging from mid-Miocene to Holocene age (CGS, 2000).

Several maps have mapped the area of the site including Helley and Brabb (1971), Dibblee (1972), Helley (1990), Helley and Wesling (1990), Helley et al. (1994), Wentworth et al. (1999), CGS (2000), Dibblee and Minch (2005), and Witter, et al. (2006). All these mappers generally agree that the site is underlain by Holocene age (younger than 11,000 years) flood basin deposits, as shown on the Site Geology Map, Figure 2. Helley et al. (1994) describe the flood basin deposits as organic-rich clay to very fine silty clay deposits occupying the lowest topographic positions between Holocene levee deposits or Holocene floodplain deposits. The flood basin deposits grade smoothly into the Holocene alluvial fans and stream sediments. Since the construction of Lake Cunningham Regional Park, the young flood basin deposits are currently overlain by artificial fill, as indicated by CGS (2000) and Witter et al. (2006).

4.2. CREEK ALIGNMENTS

The website www.historicaerials.com includes images of the site from the following years prior to and soon after development of the present-day Lake Cunningham Regional Park: 1948, 1956, 1960, 1968, and 1980. Before 1948 the site appears to have been used primarily for agricultural purposes. The 1948 aerial image available on the referenced website shows a faintly-visible linear feature that roughly coincides with the location of part of the “Lower Silver Creek” channel identified on the site plans in the 1976 and 1978 Woodward-Clyde reports. By 1956 the Lower Silver Creek channel shown in the 1976 and 1978 plans is established. By 1980 the pre-1956 channel is replaced by the current Lake Cunningham and the current alignments of Lower Silver Creek and Flint Creek, which run around portions of the inner perimeter of Lake Cunningham Regional Park.

Based on our review of the available historical imagery referenced above and the 1976 and 1978 Woodward-Clyde site plans, it appears that the pre-1956 Lower Silver Creek channel crossed the current Flint Creek levee at a nearly perpendicular angle near the location of Boring B-5.

4.3. FAULTING AND SEISMICITY

The San Francisco Bay Area is seismically dominated by the active San Andreas Fault system. This fault system movement is distributed across a complex system of generally strike-slip, right-lateral parallel and sub-parallel faults including, among others, the San Andreas, San Gregorio, Hayward, and Calaveras.

An active fault is a fault that has experienced seismic activity during historic time (since roughly 1800) or exhibits evidence of surface displacement during Holocene time (Bryant and Hart, 2007). The definition of “potentially active” varies. A generally accepted definition of “potentially active” is a fault showing evidence of displacement that is older than 11,000 years (Holocene age) and younger than 1.8 million years (Pleistocene age). However, “potentially active” is no longer used as criteria for zoning by the California Geological Survey (CGS), formerly known as the Division of Mines and Geology (DMG). The terms “sufficiently active” and “well-defined” are now used by the CGS as criteria for zoning faults under the Alquist-Priolo Earthquake Fault Zoning Act. A “sufficiently active fault” is a fault that shows evidence of Holocene surface displacement along one or more of its segments and branches, while a “well-defined” fault has a trace that is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The definition “inactive” generally implies that a fault has not been active since the beginning of the Pleistocene Epoch (older than 1.8 million years old).

Based on the information provided in Bryant and Hart (2007) and DMG (2000), the site is not located within the State-designated Alquist-Priolo Earthquake Fault Zone, where site-specific studies addressing the potential for surface fault rupture are required, and no known active faults traverse the site.

The nearest Alquist-Priolo Earthquake Fault zones are the ones associated with the Evergreen fault and the Hayward fault. The nearest segments of the Evergreen and Hayward faults are located less than a mile northeast and approximately two miles northeast of the site, respectively (DMG, 2000). Besides the Evergreen and Hayward faults, several other faults with evidence of Quaternary activity (within the past 1.8 million years) have been identified in the vicinity of Lake Cunningham Regional Park (Jennings and Bryant, 2010). These faults include the Lower Silver Creek fault (approximately 1½ mile to the southwest) and the Quimby fault (approximately 1 mile to the northeast). These two faults are not considered active by the CGS, and they are not zoned.

The site has been mapped as part of the on-going Seismic Hazards Zonation Program (CGS, 2000 and 2001) associated with liquefaction and earthquake-induced landslides. Lake Cunningham Regional Park lies within an area identified by the CGS where it is required that the potential for soil liquefaction be evaluated and characterized. Also, the southern/southeastern portion of Lake Cunningham Regional Park is situated within a Santa Clara County Hazard Zone associated with compressible soils (http://www.sccgov.org).

5. SITE AND SUBSURFACE CONDITIONS

The following sections describe general site conditions, subsurface stratigraphy and groundwater depth. Our descriptions and conclusions are based on information from the field exploration conducted for this study and on our review of available geologic and historical data pertaining to the site.

5.1 SURFACE CONDITIONS AND PERFORMANCE

Lake Cunningham Regional Park is a 202-acre water-oriented park situated in the southeast section of San Jose, just upstream of the District's Lower Silver Creek Flood Protection Project. It is bounded by Capitol Expressway to the west, Cunningham Avenue to the north, South White Road to the east, and Tully Road to the south. Lower Silver, Flint, and Ruby Creeks flow along portions of the inner perimeter of the site.

In general, the subject levees are grass-covered, with maintenance roads that run along portions of the inner perimeter and tops of the levees. According to the surveyed cross-section information provided by the District, the levees are typically between 12 and 20 feet high, measured from the inner-perimeter creek channel bottom. At the boring locations, the levee prism height ranges from about 4 to 14 feet, measured from the levee crest to the interpreted top of "native" material. Levee prism heights tend to be shorter along Flint Creek than along Lower Silver Creek. Interpreted elevations of natural (i.e., non-levee embankment) ground range from about elevation (El.) 121 feet at Boring B-3 to El. 128 feet at Boring B-5. Stratigraphy within the levees is described in Section 5.2 below.

Side slopes of the levees, as interpreted from the survey data provided by the District and as estimated in the field by Kleinfelder, generally range from about 2.5-horizontal to 1-vertical (2.5H:1V) to 4H:1V, with locally steeper and flatter slopes near features such as the creek channels and grade transitions to accommodate access roads. Levee crest widths are nominally about 12 to 20 feet. No armor surfacing was observed on any of the levee side slopes.

The levees are generally grass-covered with paved or rock surface maintenance roadways on the levee tops. Mature trees are present along the levee alignments, particularly around Flint

Creek. During our site visit, we observed several small concrete boxes that appeared to contain irrigation control valves and electrical junctions. At the time of an initial field visit (October 2014, prior to the start of the rainy season) numerous desiccation cracks up to a few inches wide and up to about 6 inches deep were present, along with frequent rodent burrows. We understand rodent burrows in the levees have been observed by City of San Jose maintenance staff over the past several years, and these burrows typically are filled in after they are first noticed.

Based on our observations, the surficial condition of the subject levee segments is generally satisfactory with respect to levee integrity, with no signs of excessive surface erosion, seepage at the levee toes, or evidence of global stability problems (such as tension cracks at or near the levee crest or slip surface scars) within the levee prisms. Our observations are consistent with the apparent satisfactory performance of the levees. To our knowledge, neither the District nor the City of San Jose has reported maintenance or levee integrity problems associated with slope instability or seepage through these levees.

5.2 LEVEE EMBANKMENT AND FOUNDATION STRATIGRAPHY

Based on our interpretations of the available subsurface information, including borings and test pits excavated for this study and the information contained in the previous Woodward-Clyde reports (Woodward-Clyde, 1976 and 1978), we found subsurface conditions to be consistent with the geologic conditions described in Section 4 above. The following sections describe our observations of the material properties of the embankment levees and foundation soils.

5.2.1 Levee Embankment

Within the upper 2 to 4 feet of the crests, the levees generally consist of silty sand and sandy lean clay to sandy silt. Below the variable silty sand/sandy lean clay surficial layer, the levee embankments generally consist of sandy lean clay and lean clay with fine sand. The lean clays and silts that comprise the majority of the levee embankments are generally firm to hard. At some locations (e.g., Boring B-3 and Test Pit TP-4), surficial silty sands were encountered to depths of up to 7½ feet below the levee crest.

As noted above in Section 2.5, tests of in-place density of the near-surface embankment fills were conducted in the field using nuclear density gauge methods. Compaction testing on bulk samples of these same fill soils was also performed. The results of these tests are noted on the test pit logs in Appendix A and are summarized below.

Table 5-1
Summary of Compaction Test and In-Place Density Results (5-foot Test Depth)

Test Pit Designation	Approximate Station (along Lower Silver Creek)	Soil Description	In-Place Dry Density (pcf)	Maximum Dry Density (pcf, ASTM D1557)	Relative Compaction
TP-1	279+00	Sandy Lean Clay, hard	122.4	126.3	97%
TP-2	270+00	Lean Clay with Sand, hard	95.2	122.7	78%
TP-3	261+00	Lean Clay with Sand, hard	112.9	128.2	88%
TP-4	250+50	Silty Sand	108.5	128.2	85%

We note that for the clayey embankment materials, the liquid limit ranges from 22 to 31, with a plasticity index range from 8 to 16. We consider this range of plasticity characteristics to be suitable for use in levee embankment construction, with a commonly recommended relative compaction per ASTM D1557 between 90 and 95 percent at the time of placement (per California Code of Regulations, 2014). With the exception of TP-1, the range of relative compaction reported in the table above falls below the recommended range of in-place density at the time of construction. Despite the low computed relative compaction, we believe the compaction of the embankment materials to be adequate based on the “firm to hard” consistency, the relatively high undrained shear strength estimates recorded in the test pits using a pocket penetrometer (over 4.5 kips per square foot), the age of the fills (at least 35 years), and adequate seepage and stability performance of the levees (see Sections 6.4 and 6.5).

At Boring B-3 (the northwestern corner of the Lower Silver Creek levee) the levee crest is about 4 to 6 feet higher than at the nearest borings B-2 and B-4, and an approximately 3-foot thick layer of asphalt concrete pavement was encountered at a depth of about 14 feet (i.e., between approximately El. 123 feet and 126 feet). At this location, the asphalt concrete layer is underlain by a 1½-foot thick layer of silty sand. The lateral extent of the buried pavement and underlying sand at this location is unknown. Neither the pavement nor the underlying silty sand layer was encountered in any of the other borings drilled for this study.

5.2.2 Foundation Soils

Below about El. 123 feet to El. 128 feet, the levee embankment fill is underlain by variable soils that range generally from firm sandy lean clay, lean clay with sand, and soft to firm sandy silt to sandy lean clay. Relatively thin (usually less than about 2 feet thick) layers of silty sand and clayey sand were occasionally encountered. Firm fat clay with sand is frequently encountered (Borings B-1, B-2 and B-4) below about El. 112 feet. However, at Boring B-5 the fat clay was encountered at a shallower depth (El 119 feet, or 12-foot depth) and based on the laboratory test data was found to be moderately to highly compressible (compression index of 0.15) and slightly overconsolidated under its current embankment load (overconsolidation ratio of about 1.3). We note that Boring B-5 is located at or near the old Lower Silver Creek channel that existed prior to development of Lake Cunningham Regional Park (see discussion in Section 4.2). The historic, buried creek channel may account for the presence of relatively thick and compressible fat clays at this location.

Lean foundation clays tend to dominate the upper 10 to 20 feet of natural foundation soil profiles at most boring locations. Laboratory test data indicate these lean foundation clays are moderately compressible and slightly overconsolidated. Drained effective stress friction angles of these lean clay foundation soils were measured to be about 32 degrees.

5.3 GROUNDWATER

As described in Section 2.3 above, groundwater was encountered in all of our borings and stabilized at elevations of about El. 113 feet to El. 123 feet (generally below the adjacent creek channel bottom). This groundwater depth observation is consistent with the mapped depth to historically high groundwater for the project vicinity (CGS, 2000), which is described to be less than about 10 feet below ground surface. We believe the groundwater level will tend to vary within the embankment with variations in rainfall and runoff patterns, the water levels in the adjacent creeks, and possibly due to other factors not apparent at the time of this study. Perched water levels could occur in the embankment fills.

5.4 VARIATIONS IN SUBSURFACE CONDITIONS

Our interpretations of soil and groundwater conditions in this report are based on data obtained from the widely-spaced borings and test pits listed above, our geologic research and laboratory test data collected for this study. The conclusions and recommendations that follow are based on our interpretations of the available data. It is likely that undisclosed variations in subsurface conditions exist at the site and that seasonal variation in groundwater levels will occur.

6. GEOTECHNICAL ENGINEERING ANALYSES AND CONCLUSIONS

Geotechnical analyses performed as part of this study include geologic hazards evaluation (with a focus on liquefaction), assessment of consolidation settlement of the levees along Lower Silver Creek in response to placing up to 3 feet of new embankment fill, assessment of allowable bearing capacity of a shallow foundation for possible new floodwalls atop the levees along Flint Creek, and evaluation of seepage and static stability analyses for the 100-year flood event.

6.1 LIQUEFACTION EVALUATION

As described above in Section 4.3, the Lake Cunningham Regional Park site lies within a CGS (2000 and 2001) mapped liquefaction hazard zone, which requires investigation of the susceptibility of the foundation soils to liquefaction-related hazards. In order for liquefaction triggering to occur due to earthquake shaking, it is generally accepted that four conditions will exist:

- The subsurface soils are in a relatively loose state
- The soils are saturated
- The soils have low plasticity
- Ground shaking is of sufficient intensity and duration to act as a triggering mechanism

After soil liquefies, dissipation of the excess pore pressures can produce volume changes within the liquefied soil layer, which can result in ground surface settlement. In recent years, several concentrated efforts have been made to come up with a uniform guideline for liquefaction triggering analyses. Youd et al. (2001) published general guidelines for liquefaction analyses, which presented the consensus of a task committee. Subsequent earthquakes in Turkey and Taiwan provided additional data to researchers, especially for low plasticity clays and silts, which resulted in significant modifications to liquefaction evaluation methods, especially for soils with higher fines contents. Two of these new methods have been presented by Seed et al. (2003) and Idriss and Boulanger (2008). Using the data collected from the borings, liquefaction analyses were performed using the methods proposed by both Seed et al. (2003) and Idriss and Boulanger (2008).

In the borings drilled for this study, silty sands, silts and clays that meet one or more of the various criteria for liquefaction susceptibility (Youd et al., 2001; Seed et al., 2003; and Idriss and Boulanger, 2008) tend to be located at or above the groundwater table, reducing the possibility for these soils to generate sufficient pore water pressure to trigger liquefaction. The affected soils are not saturated during “steady-state” conditions, which reduces the possibility for liquefaction to occur. Therefore, based on the stratigraphy and groundwater conditions in our borings and the groundwater depth information published by CGS (2001), we consider the potential for liquefaction triggering and related hazards, including liquefaction-induced settlement and lateral spreading, to be low.

6.2 LEVEE RAISE

We understand the levees along Lower Silver Creek between Tully Road and Cunningham Avenue (approximately between Sta. 264+00 and 290+00) may be raised by up to 3 feet to provide added freeboard. Raising the levees will increase the stress in the existing embankment and in the foundation soils, which will lead to elastic compression in soils above the water table and consolidation settlement in saturated soils. As described in Section 5.2 above, the embankment soils along the Lower Silver Creek reach that may be raised consist mainly of hard lean clays and silty fine sand to current embankment heights of up to about 16 to 20 feet. The foundation soils consist of firm to hard lean clay with sand, and sandy lean clay that is moderately compressible and overconsolidated. Below about El. 114 feet, the foundation clays have a higher plasticity and become hard.

6.2.1 Settlement

To investigate the effect of settlement of the existing levee in response to raising the levee by 3 feet along the Lower Silver Creek reach, we selected three cross section locations for analysis: Sta. 250+00 (near Boring B-4 – see Figure 4); Sta. 265+90 (near Boring B-3 – see Figure 5) and Sta. 282+00 (near Boring B-1 – see Figure 6). These locations were chosen due to the availability of subsurface information close to the surveyed sections over the entire reach of levee that may be raised and the presence of compressible soils in the levee foundation. To analyze the increased stresses in response to new embankment loads on the existing levees and foundations and to calculate the induced settlement, we used the finite-element computer program SIGMA/W by Geostudio and developed input parameters based on the results of our laboratory consolidation tests and judgment and experience.

The magnitude of settlement in response to new fill will depend on whether the foundation soils include relatively compressible fat clay or lean clay, which is considered to be less compressible than the fat clay. Based on the results of the consolidation tests, the existing embankment foundation soils appear to be slightly overconsolidated (overconsolidation ratio of about 1.7). Fat clay was encountered in most of the foundation soils, except in the vicinity of Boring B-3 (the northwest corner of the site), where the foundation soils consist primarily of firm lean clay.

The results of our settlement analyses show that when the levees along Lower Silver Creek are raised by 3 feet, the total computed settlement (elastic compression plus consolidation settlement) ranges from 3 to 8 inches. About 1 to 2 inches of this total settlement is due to elastic compression of the levee embankment and new fill. We expect that the elastic compression component of the settlement will occur during construction. The consolidation settlement of up to about 1 to 6 inches will likely occur slowly over a period of 20 to 30 years. Over reach lengths of up to about 500 feet, differential settlement is expected to be less than about 2 to 4 inches. The existing embankment soils are generally sandy with fines of low to moderate plasticity. Highly-plastic soils were not encountered in the levee embankment materials. Therefore, we do not expect the estimated range of settlement will lead to significant transverse or longitudinal cracking of the existing embankment materials.

6.2.2 Site Preparation

Prior to general site grading, existing vegetation, organic topsoil, and any debris should be stripped and disposed of outside the construction limits. We estimate the required depth of stripping to be approximately 3 to 6 inches in some areas of the site. Deeper stripping or grubbing may be required where concentrations of organic soils, tree roots, or animal burrows are encountered during site grading. Stripped organic soils and debris should not be incorporated into engineered embankment fill. Tree root balls and animal burrows within grading and construction limits should be fully removed, and the resulting holes should be filled with engineered embankment fill. Engineered embankment fill requirements are presented in Section 6.2.4 below.

6.2.3 Subgrade Preparation

In areas requiring placement of fill, it is recommended the fill be placed and compacted as engineered fill. Following site stripping and any required grubbing and/or over excavation, it is recommended that areas to receive engineered fill be scarified to a depth of 12 inches, uniformly moisture conditioned to within about 2 percent of the optimum moisture content and compacted to at least 90 percent relative compaction as determined by ASTM D1557.

Although near-surface soils encountered in our test pits and soil borings appeared to be sufficiently intact, there may be areas within the existing levee prism in which conditions such as significant tree roots or extensive animal burrowing may require over-excavation or scarification/recompaction efforts to depths greater than 12 inches. The amount of required overexcavation in a given area will vary and be dependent on highly localized conditions that were not encountered in our test pits and borings and should be determined in the field by the geotechnical engineer at the time of construction.

6.2.4 Engineered Embankment Fill

The excavated on-site earth materials are anticipated to vary from clayey to sandy soils. It is likely that portions of excavated onsite soils will meet the criteria for engineered fill, suitable for embankment construction. Engineered embankment material should meet the District criteria for levee fill and should be free of organic or other deleterious debris, have low plasticity, have a maximum particle size less than 4 inches, and a permeability of less than 1×10^{-6} cm/sec. Typical District requirements for engineered embankment levee fill and applicable test procedures to evaluate material suitability are provided in Table 6-1 below.

Table 6-1
Engineered Embankment Fill

		Test Procedures	
Fill Requirement Gradation		**ASTM[1]**	**Caltrans[2]**
Sieve Size	Percent Passing		
4 inch	100	C 136	202
No. 4	75-100	C 136	202
No. 200	50-100	C 136	202
Plasticity			
Liquid Limit	Plasticity Index		
<40	10 to 20	D 4318	204
Organic Content			
Less than 3%		D 2974	---

Notes:
[1] American Society for Testing and Materials International Standards (latest edition)
[2] State of California, Department of Transportation, Standard Test Methods (latest edition)

All imported fill materials to be used for engineered embankment fill should be sampled and tested for compliance with project requirements prior to being transported to the site.

6.2.5 Engineered Embankment Fill Compaction Criteria

Engineered embankment fill should be uniformly moisture conditioned to within about 2 percent of the optimum moisture content, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to at least 92 percent relative compaction.

6.3 FLOODWALL ALONG FLINT CREEK

We understand a floodwall up to 3 feet high may be added to the top of the levee reach along Flint Creek. As described in Section 5.2 above, the embankment soils along the Flint Creek reach that may receive a new floodwall consist of hard lean clay with sand, with possibly increasing sand content toward the eastern end of the reach (near South White Road). The levee along Flint Creek (about 4 to 9 feet tall) is shorter than the Lower Silver Creek Levee (about 14 to 15 feet high) and tends to be more narrow – about 8 to 10 feet wide along the crest between about Sta. 12+00 (Boring B-6) and Sta. 2+00 (Boring B-5). Along this reach of levee we believe the existing crest width is wide enough to facilitate construction of a floodwall founded on a conventional "T" or cantilevered spread footing. The selection of footing type will depend in part on available levee crest roadway width. A cantilevered spread footing will allow preservation of more existing roadway width than a "T" spread footing. Between approximately Sta. 12+00 and the park entrance at South White Road the levee crest is fairly narrow – ranging from about 3 feet in the vicinity of Sta. 12+00 and generally widening to about 7-foot width near the park entrance. Along this relatively narrow reach, we expect contractors may have difficulty constructing a floodwall with a conventional spread footing. However, a specialty contractor may be able to install a drilled pier-supported floodwall along this reach. Development of recommendations for design and construction drilled pier foundations are outside the scope of this report.

6.3.1 Bearing Pressure, Settlement and Lateral Resistance

Spread footings for a floodwall along the reach between Sta. 12+00 and Sta. 2+00 may be founded on existing levee embankment fill soils at a depth of at least 24 inches and designed for a net allowable bearing pressure of 3,000 pounds per square foot. This net allowable bearing pressure includes a safety factor of at least 3 with respect to shear failure of the foundation soils. The net allowable bearing pressure may be increased by a factor of one third to account for transient pressures due to wind or seismic loads.

Lateral loads may be resisted by a combination of friction between the foundation bottoms and the supporting subgrade, and by passive resistance acting against the vertical faces of the foundations. An allowable coefficient of friction of 0.30 between the foundation and supporting subgrade may be used. For passive resistance, an allowable equivalent fluid pressure of 300 pounds per cubic foot acting against the footings may be used. The friction and passive resistance values include a factor of safety of at least 1.5. The friction coefficient and passive resistance may be used concurrently. We recommend that the top 12 inches of soil cover be neglected in the passive resistance calculations if the ground surface above is not confined by a slab, pavement, or some similar protection.

For foundations designed and constructed in accordance with our recommendations the estimated total settlement is up to about one inch. Differential settlement across the wall length may be up to about ½ inch.

6.3.2 Foundation Site Preparation

The recommendations provided above in Sections 6.2.2 and 6.2.3 pertaining to site preparation apply to subgrade preparation for areas to receive concrete foundations. The exposed foundation subgrade should be scarified to a depth of at least 8 inches, uniformly moisture conditioned to at least 2 percent above optimum moisture content, and compacted to at least 90 percent relative compaction per ASTM D1557. The subgrade should not be allowed to dry out prior to the placement of engineered fill or concrete improvements.

Concrete for foundations should be placed neat against properly-prepared subgrade soils. It is important that footing excavations in clayey soils not be allowed to dry out before placing concrete. If shrinkage cracks appear in the footing excavations, the excavations should be thoroughly moistened to close all cracks prior to concrete placement. The foundation excavations should be observed by a geotechnical engineer for compliance with appropriate moisture control and to confirm the adequacy of the supporting soils. If soft or loose materials are encountered at the bottoms of footing excavations, they should be removed and replaced with lean concrete or additional foundation concrete.

6.4 SEEPAGE ANALYSES

Seepage was evaluated at four typical sections provided by the District:

- Sta. 2+00, Flint Creek (near Boring B-5) – See Figure 3
- Sta. 250+00, Lower Silver Creek (near Boring B-4) – See Figure 4
- Sta. 265+90, Lower Silver Creek (near Boring B-3) – See Figure 5
- Sta. 282+00, Lower Silver Creek (near Boring B-1) – See Figure 6

Figures 3 through 6 show simplified subsurface stratigraphy and soil parameters, which were developed based on the available geotechnical data from our field and laboratory test results. Permeability parameters were estimated based on experience with similar soils on other levee evaluation projects. Seepage analysis was performed using the finite element program Seep/W by Geo-Slope International, Ltd. The design 100-year water surface elevation, as provided by the District, is El. 133 feet.

Flood durations of up to about 27 to 28 hours are presented in the hydrologic data provided by the District. The hydrographs for the analysis locations are presented in Appendix C. Assuming the estimated flood durations on the “creek” sides of the levees were sufficient to establish steady-state seepage conditions, the calculated gradients at the toes of the “landside” (outside of the park) slopes, illustrated on Figures 7 through 10, range from 0.50 to 0.92, which mostly exceed the USACE critical gradient criterion of 0.5. In our experience, the USACE critical gradient criterion of 0.5 represents a commonly-accepted industry criterion that is accepted by FEMA.

In addition to the steady-state seepage analyses described above, we also analyzed seepage at two of the "worst-case" steady-state seepage sections using a transient flood condition using hydrographs provided by the District. The sections selected for transient seepage analysis include Sta. 2+00 and Sta. 250+00. As shown on Figures 11 (Sta. 2+00) and 12 (Sta. 250+00), after about 21 to 24 hours of flood loading on the levee bank, and with water surface at the design flood elevation of El. 133 feet, the wetted front does not exceed about 2 to 5 feet of penetration into the levees. We believe the transient seepage analyses presented on Figures 11 and 12 represent the expected seepage behavior at the levees.

The results of the seepage analyses described above and as presented on Figures 7 through 12 are summarized below.

Table 6-2
Results of Seepage Analyses

Station	Analysis Type	Computed Seepage Gradient at "Outside" Toe	Figure with Illustrated Results	Comment
2+00	Steady-State	0.57	7	Exceeds critical gradient criterion
	Transient	nil	11	Meets critical gradient criterion
250+00	Steady-State	0.92	8	Exceeds critical gradient criterion
	Transient	0.23	12	Meets critical gradient criterion
265+90	Steady-State	0.50	9	Meets critical gradient criterion
282+00	Steady-State	0.80	10	Exceeds critical gradient criterion

We believe steady-state seepage conditions are unlikely to develop anywhere within the Lower Silver Creek and Flint Creek levees during the flood events expected by the District. Therefore, we consider the seepage performance of these existing levees to be adequate.

6.5 SLOPE STABILITY ANALYSES

The cases analyzed for slope stability include long-term (effective stress) conditions with steady state seepage along the interior levee slopes, rapid drawdown and end-of-construction following a 3-foot levee raise along Lower Silver Creek. Stability analyses were conducted at the same sections that were analyzed for seepage and illustrated on Figures 3 through 6.

In accordance with USACE and FEMA analysis criteria, seismic stability of the creek bank slopes was considered but not analyzed. Two conditions were accounted for in this determination. The first was that it is generally unlikely that the design water surface elevation will occur coincidentally with the design earthquake. Secondly, based on guidance in USACE (2010) EC 1110-2-6067, the levee slopes will not be subjected to extended periods of water loading on an annual basis, and the duration of the peak flow is short (no more than about 24 hours – too short to fully wet the levee). As such, it is unlikely that the bank slopes would become saturated and be adversely affected during a seismic event.

6.5.1 Static Stability

A phreatic surface was developed for the steady state condition assuming the design 100-year flood elevation of El. 133 feet. The limit equilibrium computer program SLOPE/W was used to perform the stability analyses. Circular failure surfaces initiating through the levee near the toe of the slope were assumed to be the dominant method of failure. Shallow, surficial slumps that do not involve a substantial portion of the levee and toe are not considered critical and were not evaluated.

The analyses consisted of performing a search routine to identify the critical failure surface using Spencer’s Method. Assumed parameters for each of the materials used in the static stability analyses are shown on Plates 13 through 16. A summary of the slope stability analysis results for steady-state seepage conditions is presented in the table below.

Table 6-3
Results of Stability Analyses
Static, Steady-State Flood Conditions

Station	Computed Factor of Safety	Figure with Illustrated Results	Comment
2+00	2.93	13	Critical failure surface involves crest and toe.
250+00	2.53	14	Critical failure surface involves toe and significant portion of slope.
265+90	1.71	15	Critical failure surface is trivial and shallow. Actual safety factor for a substantial portion of the embankment will exceed 2.
282+00	2.68	16	Critical failure surface is shallow and does not involve a substantial portion of the embankment.

The analyses results summarized above and presented on Figures 13 through 16 are based on the assumption that hydraulic conditions in the creek channel will permit the development of steady-state (i.e., long-term) seepage conditions and that effective stress soil parameters apply. As discussed above, it is unlikely that steady-state seepage conditions will develop in the levee slopes. Therefore, we consider the steady-state stability analyses inside the levee system to be conservative, and the Corps of Engineers criterion for computed safety factor of 1.4 is conservative and satisfied.

6.5.2 Rapid Drawdown Stability

Based on the results of the transient seepage analyses described in Section 6.4 above, during storm loading the penetration into the levees of the wetted front from the retained water is shallow – less than about 5 feet. Under these conditions, rapid drawdown analyses for a post-flood case normally are not necessary. However, for this screening-level study we analyzed one section to demonstrate adequate stability under rapid drawdown conditions assuming that the levee were to become saturated. The section at Sta. 265+90 was selected because it resulted in the lowest (most critical) safety factor for static, steady-state stability analysis as described above.

We conducted rapid-drawdown analyses with the conservative assumption that steady-state seepage conditions develop during storm loading, followed by a rapid lowering of the water level. The results of these analyses are illustrated on Figures 17 and 18 for the “upper” and “lower” portions, respectively, of the “waterside” levee slope at Sta. 265+90. Computed safety factors range from 2.23 (“upper” portion of the slope) to 1.58 (“lower” portion of the slope). These computed safety factors at Sta. 265+90 are considered to indicate adequate stability of the levees under rapid-drawdown conditions. Any slope failures due to a rapid drawdown condition following the design 100-year flood in the basin are likely to be limited to shallow, surficial slumps that are unlikely to involve significant movement of material from the levee toe and crest.

6.5.3 End of Construction Stability

We understand portions of the levees along Lower Silver Creek may be raised in the future by up to 3 feet. To demonstrate adequate stability for this screening level study we selected the section at Sta. 265+90, which resulted in the lowest (most critical) computed safety factor for static, steady-state stability analysis as described above. Using total stress parameters for the existing levee and foundation soils and 3 feet of new levee fill that consists of primarily granular material, the resulting computed safety factor is 1.95, which involves a slip surface on the “upper” portion of the slope. The results of this analysis are illustrated on Figure 19. The computed safety factor is considered to be adequate and representative of the levees under end-of-construction conditions.

7. SUMMARY AND RECOMMENDED ADDITIONAL STUDY

Following is a summary of key conclusions with respect to FEMA acceptance of the levees along Lower Silver Creek and Flint Creek at Lake Cunningham Regional Park. These conclusions are developed based on the results of a screening-level geotechnical investigation and engineering analyses for possible future FEMA certification, as described in earlier sections of this report. A comprehensive study and alternatives analyses that would be required for FEMA certification is outside the current scope of this study.

- Geologic Hazards and Subsurface Characterization. Based on the results of this screening-level study, Kleinfelder believes that the existing levees and foundation materials at the boring locations are not susceptible to significant liquefaction hazards. This conclusion should be confirmed through additional subsurface investigation, laboratory testing and engineering analyses.

  The subsurface explorations performed for this screening-level study are widely spaced – roughly 800 feet to more than 1,000 feet apart. This wide boring spacing leaves uncertainty with respect to subsurface conditions within the levee prism and in the foundation soils. With more closely-spaced subsurface explorations, variability and uncertainty between the existing boring locations will be reduced, and unevaluated portions of the complete levee improvement area could be investigated for other design details including seepage and stability. For final design we recommend that additional explorations be added to reduce the span between explorations to no more than 500 feet. Additional explorations could include a combination of additional soil borings and cone penetration tests conducted to depths of up to about 30 to 40 feet.

- Geomorphology. This screening-level study did not include a comprehensive review and analysis of the geomorphology of the site for evaluation of recent geologic history and land use changes on the performance of the creek channels and levees. A geomorphological study performed as part of a design-level evaluation will provide further insight into how changes in near-surface geology and topographical features, such as rerouting of creeks, may affect seepage and stability of the levees. A design-level geomorphological study would include further review and analysis of aerial photographs, including analysis of stereo pairs.

- Embankment Geometry. As described in Section 5.1, the existing embankment levees appear to have adequate geometry with few instances of oversteepened slopes or signs of past embankment distress and seepage.
- Trees and Other Vegetation. Most of the levee alignments have significant tree growth on and around the levees, including large trees in the slopes. We recommend that a future phase of levee evaluation include involvement of a qualified arborist to assess the general health of the trees and to look for trees or other significant vegetation that could damage the levee if, for instance, a tree were to become diseased, fall, and damage the levee integrity or disrupt free-flow of water through the creek channels during storm events.
- Levee Materials. The existing levee materials appear to have been constructed using appropriate materials for use as structural levee embankment fill, as evidenced by satisfactory seepage and stability performance.
- Levee Raise along Lower Silver Creek. Based on the results of laboratory testing and settlement analyses, in our opinion the existing levees adjacent to Lower Silver Creek may be raised by up to 3 feet with expected post-construction, time-dependent consolidation settlements of about 1 to 6 inches that are expected to occur over a period of about 20 to 30 years. A detailed review of potential borrow sources within Lake Cunningham Regional Park could be undertaken to confirm suitability of existing, on-site soils for use as embankment fill. This preliminary report includes criteria for selection of embankment fill materials.
- Floodwall Construction along Flint Creek. Between approximate Sta. 12+00 and 2+00 the embankment crest appears sufficiently wide to accommodate a floodwall with a conventional spread footing design. This preliminary report provides geotechnical design recommendations for design and construction of floodwall footings. However, between Sta. 12+00 and the park entrance on South White Road the levee crest is too narrow and the levee slope is too steep to accommodate a conventional spread footing. Drilled pier construction would also likely be difficult along this reach due to geometric constraints. A specialty foundation drilling contractor may be able to install a drilled pier-supported floodwall along this reach.
- Seepage and Stability Performance. At the analysis sections considered for this screening-level study, the existing levee configuration meets FEMA performance criteria

for seepage and stability under the 100-year flood scenario. For a final certification-level geotechnical evaluation, additional borings and/or cone penetration tests should be conducted along selected sections to refine the foundation stratigraphy and to look for sand layers that could allow seepage through or under the levee system.

We recommend Kleinfelder conduct a general review of final plans, specifications and contractor submittals to evaluate that our geotechnical recommendations have been properly interpreted and implemented during design. In the event Kleinfelder is not retained to perform this recommended review, we will assume no responsibility for misinterpretation of our recommendations.

8. LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

The creek channel and levee environment is dynamic and subject to changes that could occur rapidly due to storm-related events and channel maintenance. This report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than five years from the date of the report. If the conclusions and recommendations in this report are to be referenced for design modifications after two years from the report date, the creek channel and levee conditions should be reviewed to verify that no significant changes to the site conditions have occurred due to external environmental factors.

If Client does not retain Kleinfelder to review any plans and specifications, including any revisions or modifications to the plans and specifications, Kleinfelder assumes no responsibility for the suitability of our recommendations. In addition, if there are any changes in the field to the plans and specifications, Client must obtain written approval from Kleinfelder's engineer that such changes do not affect our recommendations. Failure to do so will vitiate Kleinfelder's recommendations.

9. REFERENCES

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FIGURES

LEGEND

- BORING LOCATION
- TEST PIT LOCATION
- BORING LOCATION (by Woodward-Clyde 1978)
- BORING LOCATION (by Woodward-Clyde 1976)
- CROSS SECTION LOCATION

NOTE:
BORING AND TEST PIT LOCATIONS ARE APPROXIMATE AND WERE NOT SURVEYED.

GIS Alignment for Silver Creek and Flint Creek. 2001 Ortho Photo.

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N

200 100 0 200
APPROXIMATE SCALE (feet)

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DRAWN BY:	AG
CHECKED BY:	MF
FILE NAME:	2012_205_CrossSections.dwg

SITE PLAN

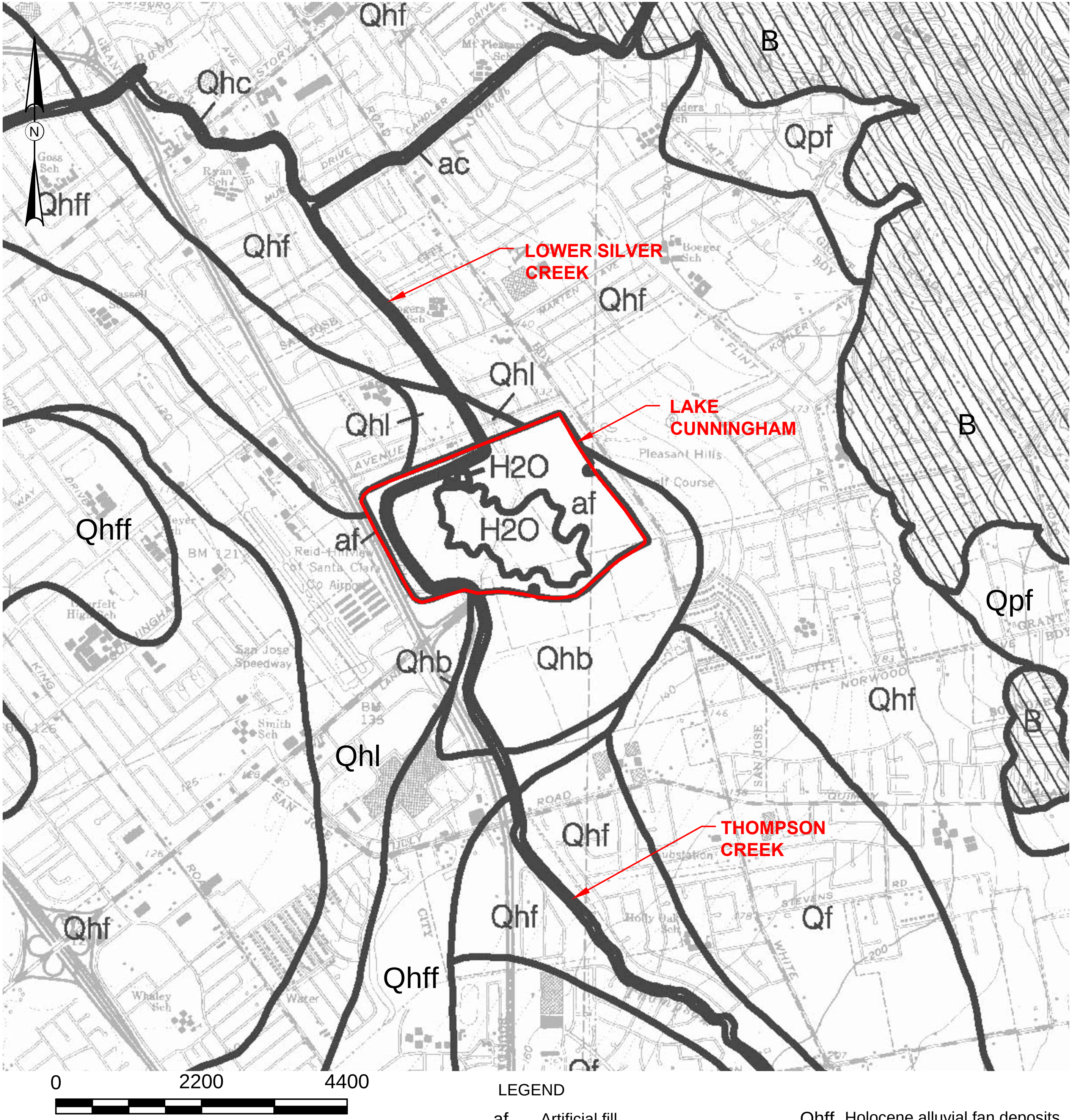
CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

FIGURE
1

ATTACHED IMAGES: Images: Lake Cunningham Ortho.jpg Images: photo.JPG
ATTACHED XREFS:
CAD FILE: C:\Users\agekas\Documents_ALL CADD-DOCUMENTS_CAD-WORK IN PROGRESS\20150225_Lake Cunningham Berms\ LAYOUT: D-Size(2) PLOTTED: 07 Apr 2015, 1:26pm, agekas
Oak-L:\2009\09Projects

PLOTTED: 4/7/2015 1:34 PM BY: arete gekas

CAD FILE: C:\Users\agekas\Documents\__ALL CADD-DOCUMENTS__CAD-WORK IN PROGRESS\20150225_Lake Cunningham Berms\GRAPHICS\SITE.dwg



SCALE: 1" = 2200' SCALE IN FEET

REFERENCE: California Division of Mines and Geology Staff, 2000, Seismic Hazard Evaluation of the San Jose East 7.5-minute Quadrangle, Santa Clara County, California: California Division of Mines and Geology, Open-File Report 2000-010, scale 1:24,000

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LEGEND

af	Artificial fill
ac	Artificial stream channel
Qhc	Modern stream channel deposits
Qhb	Holocene basin deposits
Qhf	Holocene alluvial fan deposits
Qhff	Holocene alluvial fan deposits, fine grained facies
Qhl	Holocene alluvial fan levee deposits
Qf	Late Pleistocene to Holocene alluvial fan deposits
Qpf	Late Pleistocene alluvial fan deposits
B	Pre-Quaternary Bedrock

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CHECKED BY:	OK
DATE:	04-07-2015
REVISED:	

SITE GEOLOGY MAP

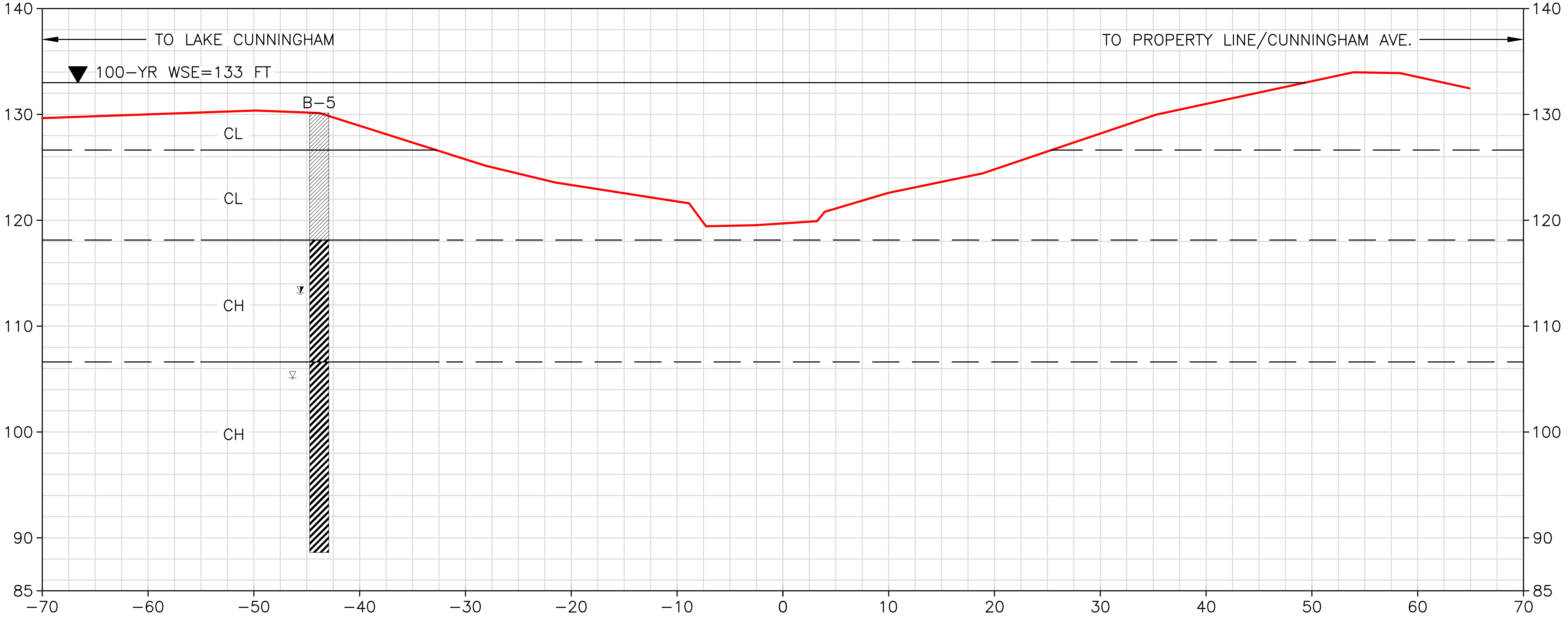
CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

FIGURE

2

CAD FILE: C:\Users\agekas\Documents\__ALL CADD-DOCUMENTS__CAD-WORK IN PROGRESS\20150225_Lake Cunningham Berms\Cunningham Geotechnical Investigation.dwg LAYOUT: 2+00 PLOTTED: 4/7/2015 1:32 PM BY: arete gekas

STATION 2+00, FLINT CREEK



0 10 20

SCALE: 1" = 10' SCALE IN FEET

NOTES:

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY SCVWD AND DATED AUGUST, 2012.
2. SEE DETAILED BORING LOGS IN APPENDIX A FOR ADDITIONAL INFORMATION.

SUBSURFACE MATERIAL PROPERTIES

LAYER	Ky/Kx	Kh, ft/day	Ø	c
1. LEAN CLAY WITH SAND (CL) [LEVEE FILL]	0.25	0.028	30°	50 psf
2. LEAN CLAY WITH SAND (CL) [NATIVE]	0.25	0.028	28°	50 psf
3. FAT CLAY (CH) [NATIVE]	0.25	0.028	28°	100 psf
4. FAT CLAY WITH SAND (CH) [NATIVE]	0.25	0.028	30°	100 psf

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CHECKED BY M. John
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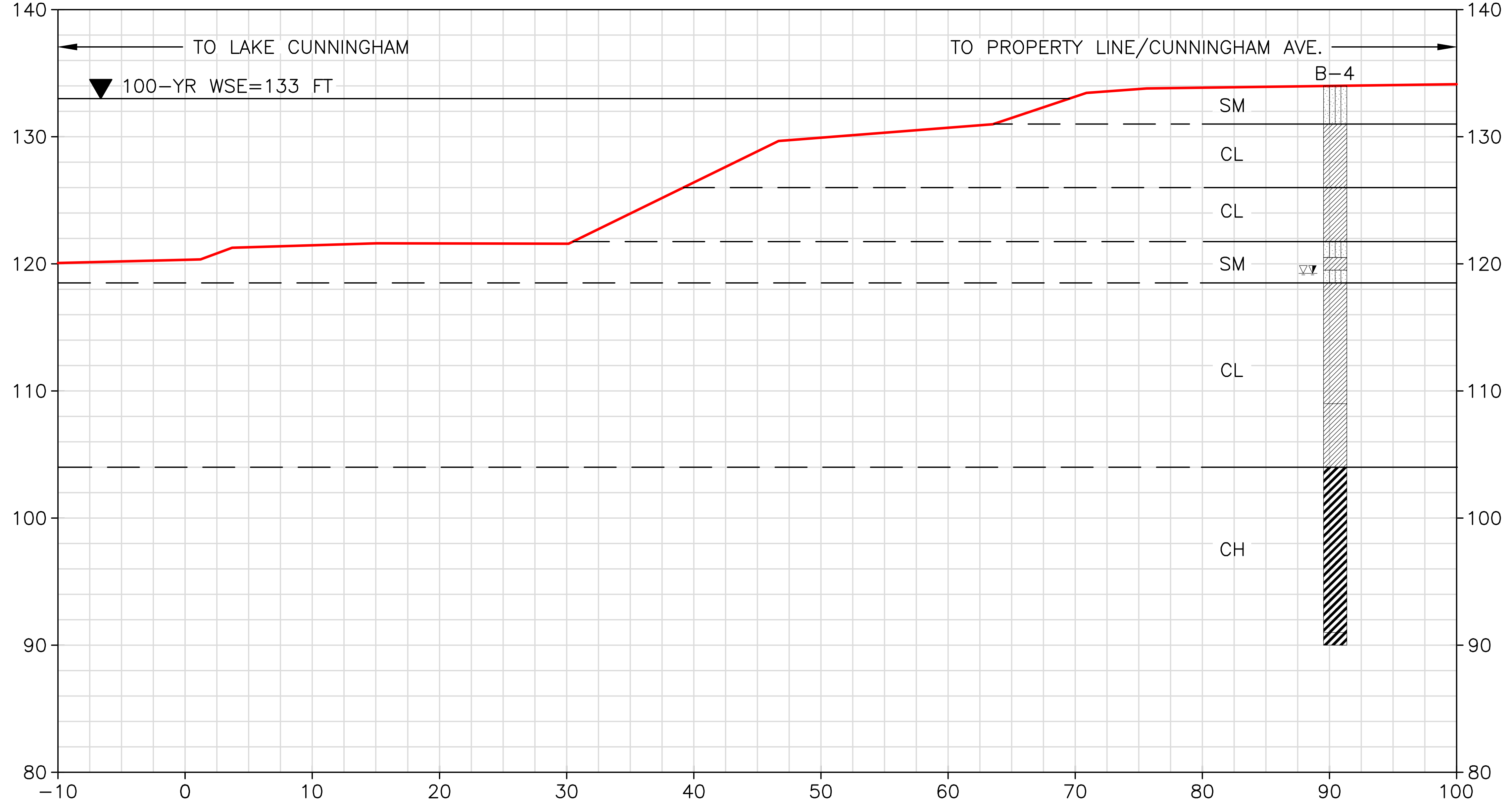
STATION 2+00
FLINT CREEK

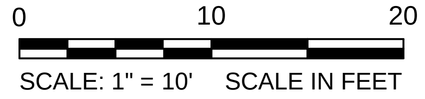
CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

FIGURE
3

CAD FILE: C:\Users\agekas\Documents\__ALL CADD-DOCUMENTS__CAD-WORK IN PROGRESS\20150225_Lake Cunningham Berms\Cunningham Geotechnical Investigation.dwg LAYOUT: 250+00 PLOTTED: 4/7/2015 1:32 PM BY: arete gekas

STATION 250+00, SILVER CREEK





SCALE: 1" = 10' SCALE IN FEET

NOTES:

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY SCVWD AND DATED AUGUST, 2012.

2. SEE DETAILED BORING LOGS IN APPENDIX A FOR ADDITIONAL INFORMATION.

SUBSURFACE MATERIAL PROPERTIES

LAYER	Ky/Kx	Kh, ft/day	Ø	c
1. SILTY SAND (SM) [LEVEE FILL]	0.25	1.12	30°	0
2. LEAN CLAY WITH SAND (CL) [LEVEE FILL]	0.25	0.028	28°	50 psf
3. SANDY LEAN CLAY (CL) [FILL]	0.25	0.028	30°	50 psf
4. SILTY SAND (SM) [NATIVE]	1.00	1.12	28°	0
5. LEAN CLAY (CL) [NATIVE]	0.25	0.028	32°	0
6. FAT CLAY (CH)	0.25	0.028	30°	100 psf

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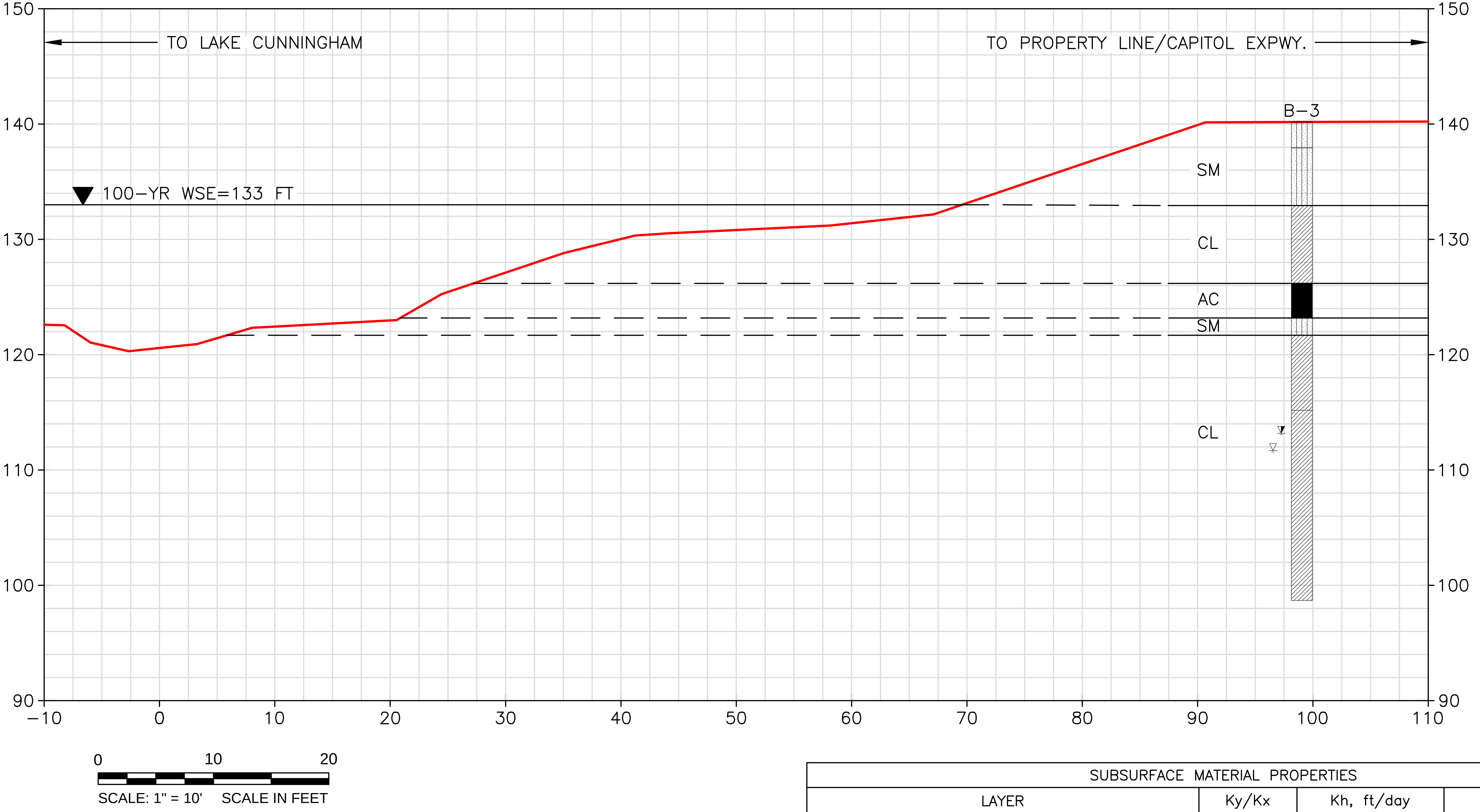
STATION 250+00
SILVER CREEK

CUNNINGHAM FLOOD DETENTION FAICLITY
EXISITING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

FIGURE
4

PAGE: 01 of 04

STATION 265+90, SILVER CREEK



NOTES:

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY SCVWD AND DATED AUGUST, 2012.
2. SEE DETAILED BORING LOGS IN APPENDIX A FOR ADDITIONAL INFORMATION.

SUBSURFACE MATERIAL PROPERTIES

LAYER	Ky/Kx	Kh, ft/day	Ø	c
1. SILTY SAND (SM) [LEVEE FILL]	1.00	1.12	32°	0
2. LEAN CLAY WITH SAND (CL) [LEVEE FILL]	0.25	0.028	28°	50 psf
3. ASPHALT CONCRETE [FILL]	1.00	1.12	30°	0
4. SILTY SAND (SM) [NATIVE]	1.00	1.12	30°	0
5. LEAN CLAY (CL) [NATIVE]	0.25	0.028	32°	0

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STATION 265+90
SILVER CREEK

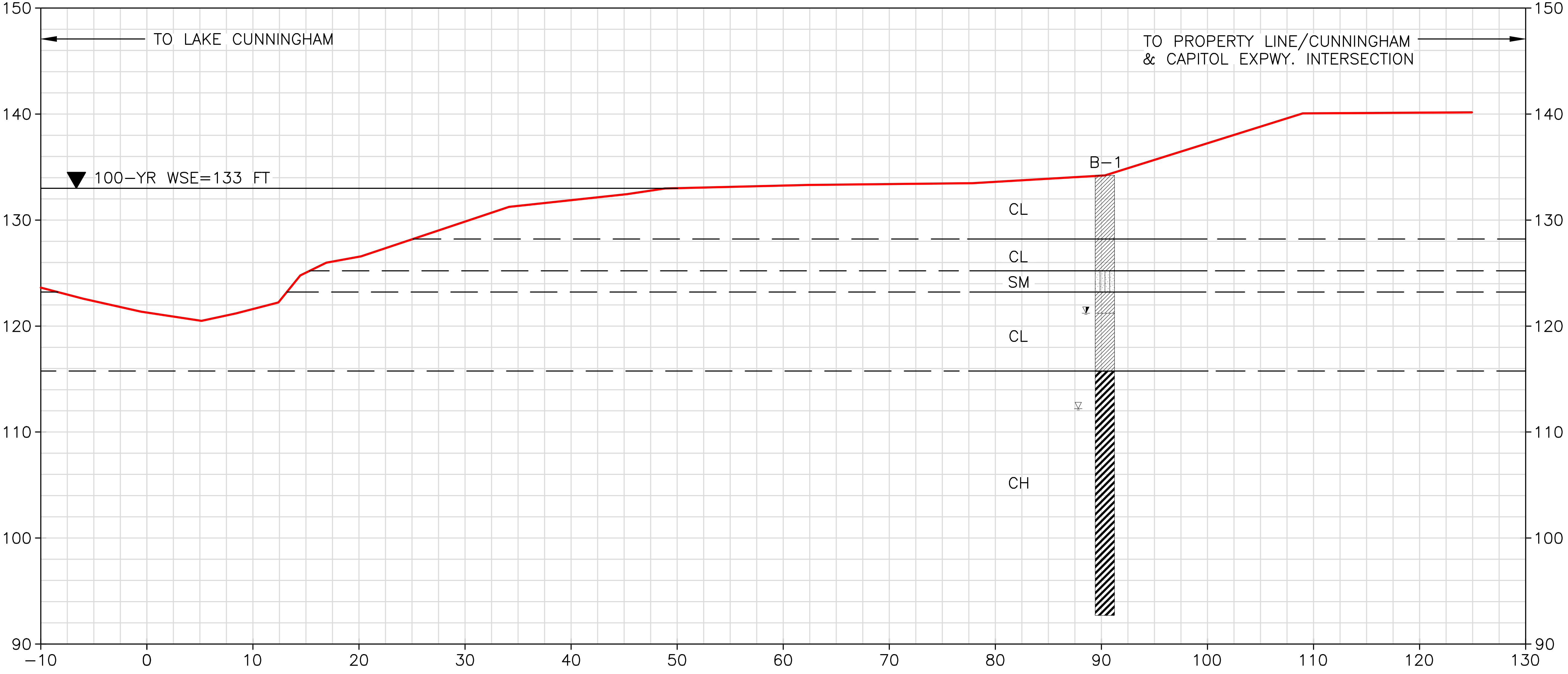
CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

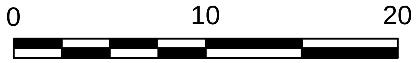
FIGURE
5

CAD FILE: C:\Users\agekas\Documents\__ALL CADD-DOCUMENTS__CAD-WORK IN PROGRESS\20150225_Lake Cunningham Berms\Cunningham Geotechnical Investigation.dwg LAYOUT: 265+90 PLOTTED: 4/7/2015 1:32 PM BY: arete gekas

CAD FILE: C:\Users\agekas\Documents\__ALL CADD-DOCUMENTS__CAD-WORK IN PROGRESS\20150225_Lake Cunningham Berms\Cunningham Geotechnical Investigation.dwg LAYOUT: 282+00 PLOTTED: 4/7/2015 1:32 PM BY: arete gekas

STATION 282+00, SILVER CREEK





SCALE: 1" = 10' SCALE IN FEET

NOTES:

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY SCVWD AND DATED AUGUST, 2012.
2. SEE DETAILED BORING LOGS IN APPENDIX A FOR ADDITIONAL INFORMATION.

SUBSURFACE MATERIAL PROPERTIES

LAYER	Ky/Kx	Kh, ft/day	Ø	c
1. LEAN CLAY (CL) [LEVEE FILEE]	0.25	0.028	28°	50 psf
2. SANDY LEAN CLAY (CL) [NATIVE]	0.25	0.028	30°	50 psf
3. SILTY SAND (SM) [NATIVE]	1.00	1.12	28°	0
4. SANDY LEAN CLAY (CL) [NATIVE]	0.25	0.028	30°	50 psf
5. FAT CLAY WITH SAND (CH) [NATIVE]	0.25	0.028	30°	100 psf

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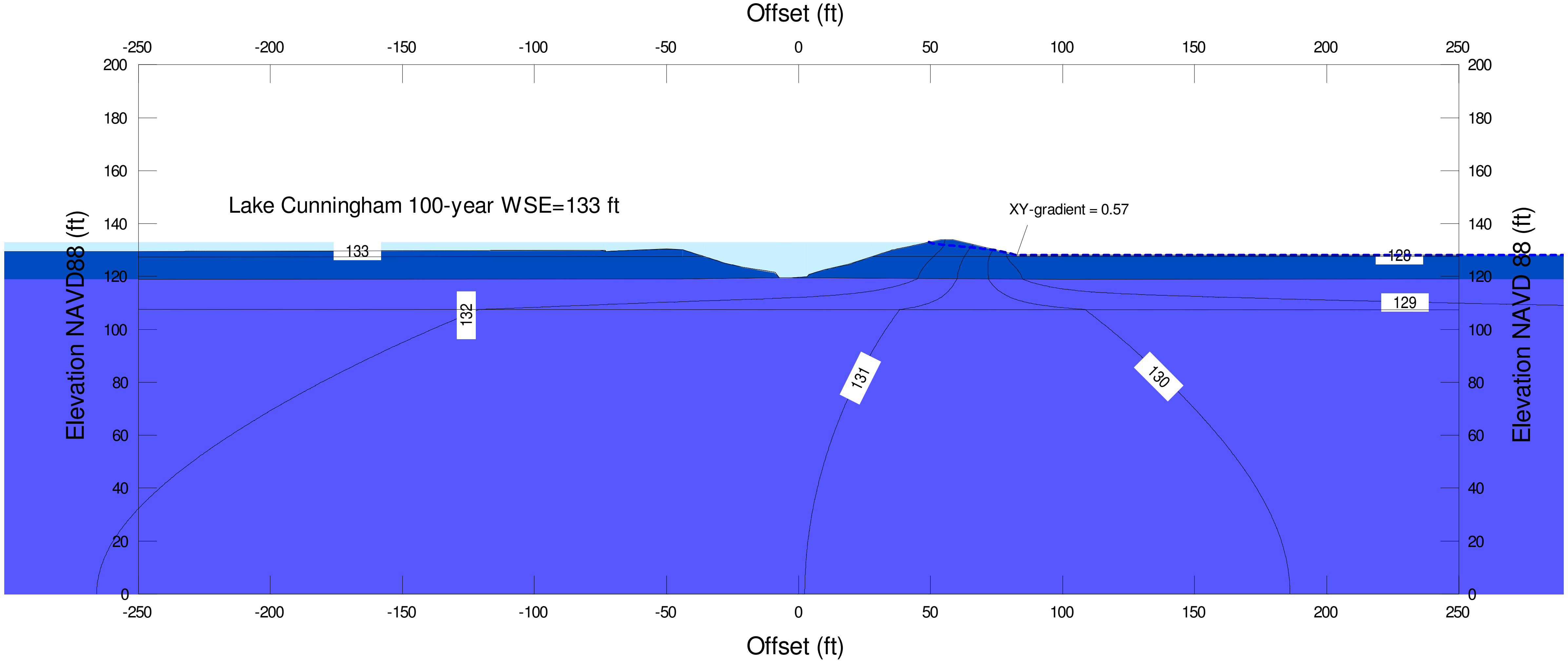
STATION 282+00
SILVER CREEK

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

FIGURE
6

Title: Lake Cunningham - Station 2+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station2+00.gsz
Name: Steady-State Seepage

Name: Lean Clay with Sand (CL) Levee Fill K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25
Name: Lean Clay with Sand (CL) Native K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25
Name: Fat Clay (CH) Native K-Function: Clay - Levee Embankment Fill Ks=0.0028 ft/day (1.0x10E-6 cm/s) Ky'/Kx' Ratio: 0.25
Name: Fat Clay with Sand (CH) Native K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25



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CHECKED BY:	M. Fuhriman
Date:	02/11/2015
FILE NAME:	20150225.002A_SeepSlopeFigures.pub

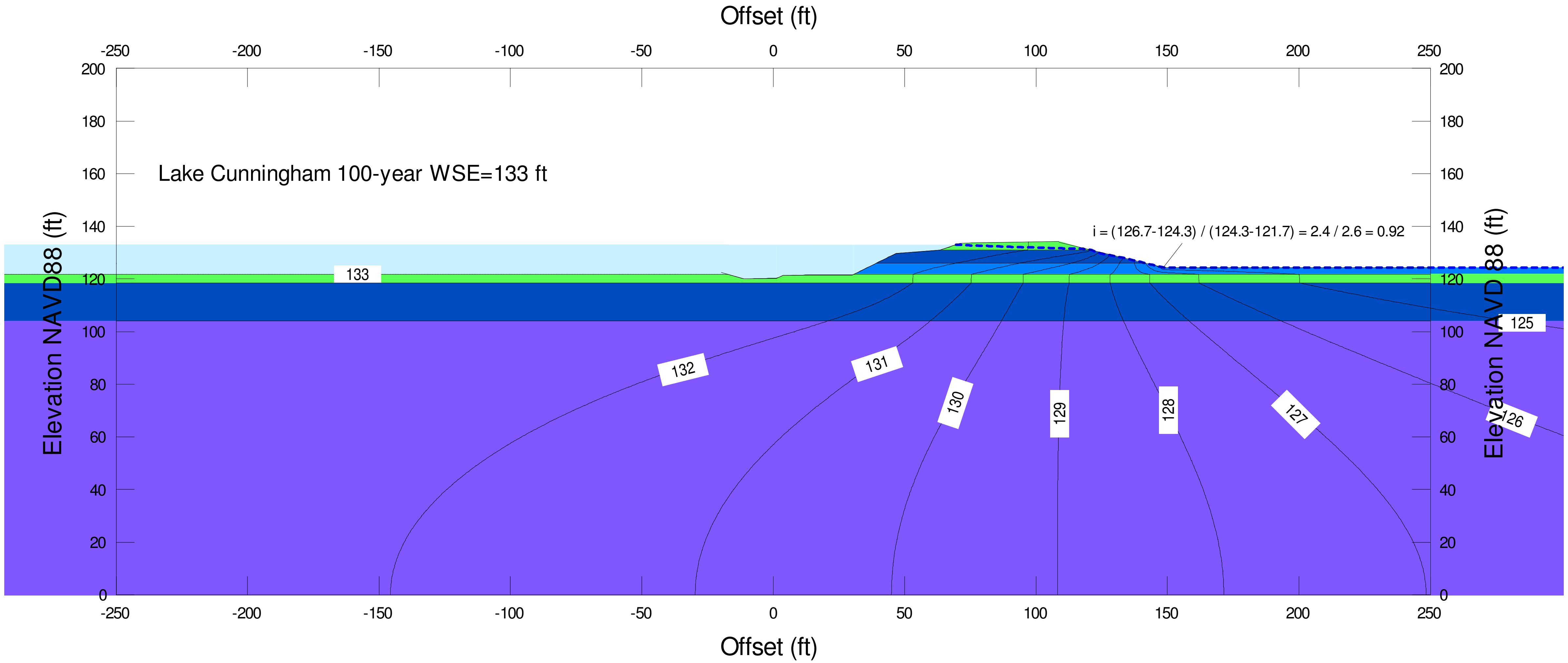
Station 2+00—Flint Creek
Steady State Seepage Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
7

Title: Lake Cunningham - Station 250+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station250+00.gsz
Name: Steady-State Seepage

Name	K-Function	Ky'/Kx' Ratio
Name: Silty Sand (SM) Levee Fill	K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Lean Clay with Sand (CL) Levee Fill	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Sandy Lean Clay (CL) Levee Fill	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Silty Sand (SM) Native	K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s)	Ky'/Kx' Ratio: 1
Name: Lean Clay (CL) Native	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Fat Clay (CH) Native	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25



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Date: 02/11/2015
FILE NAME: 20150225.002A_SeepSlopeFigures.pub

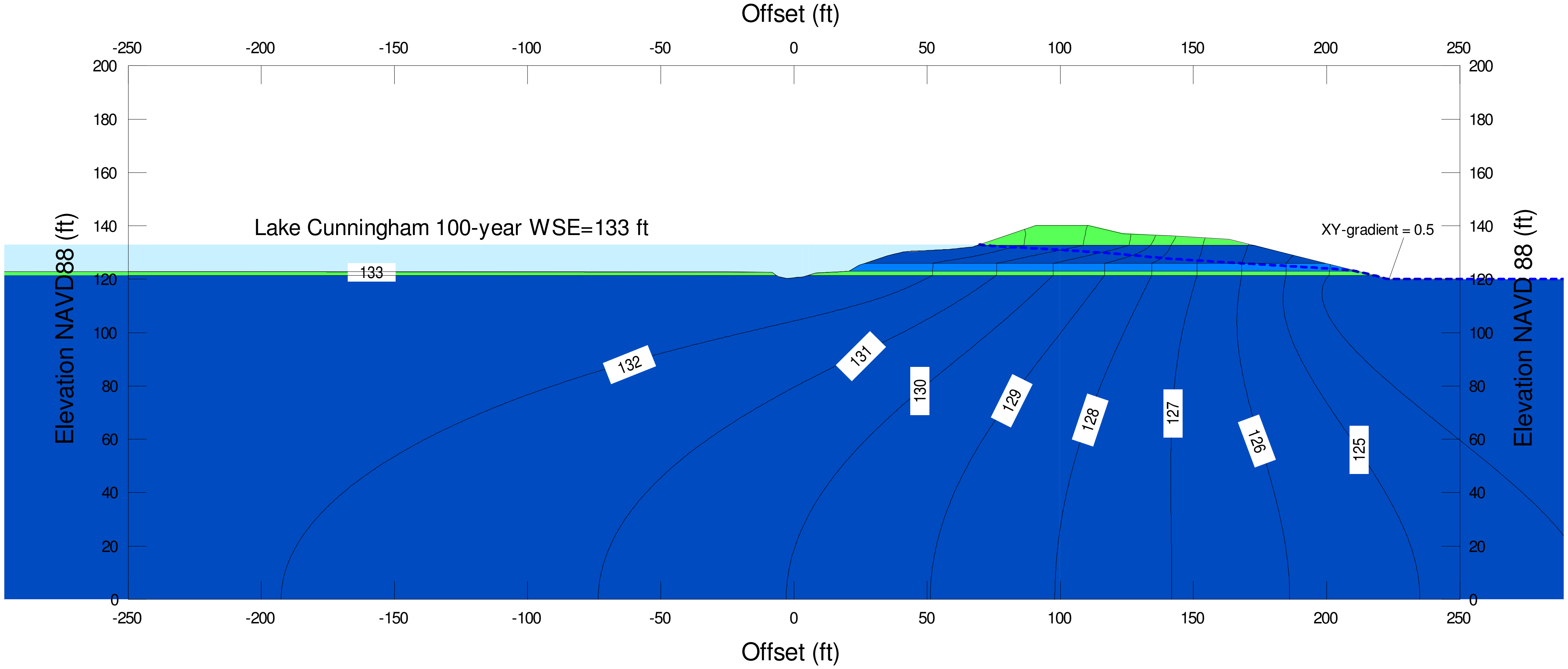
Station 250+00—Lower Silver Creek
Steady State Seepage Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
8

Title: Lake Cunningham - Station 265+90
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station265+90.gsz
Name: Steady-State Seepage

Name: Silty Sand (SM) Levee Fill K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s) Ky'/Kx' Ratio: 0.25
Name: Lean Clay with Sand (CL) Levee Fill K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25
Name: Asphalt Concrete (Fill) K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s) Ky'/Kx' Ratio: 1
Name: Silty Sand (SM) Native K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s) Ky'/Kx' Ratio: 1
Name: Lean Clay (CL) Native K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25



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FILE NAME:
20150225.002A_SeepSlopeFigures.pub

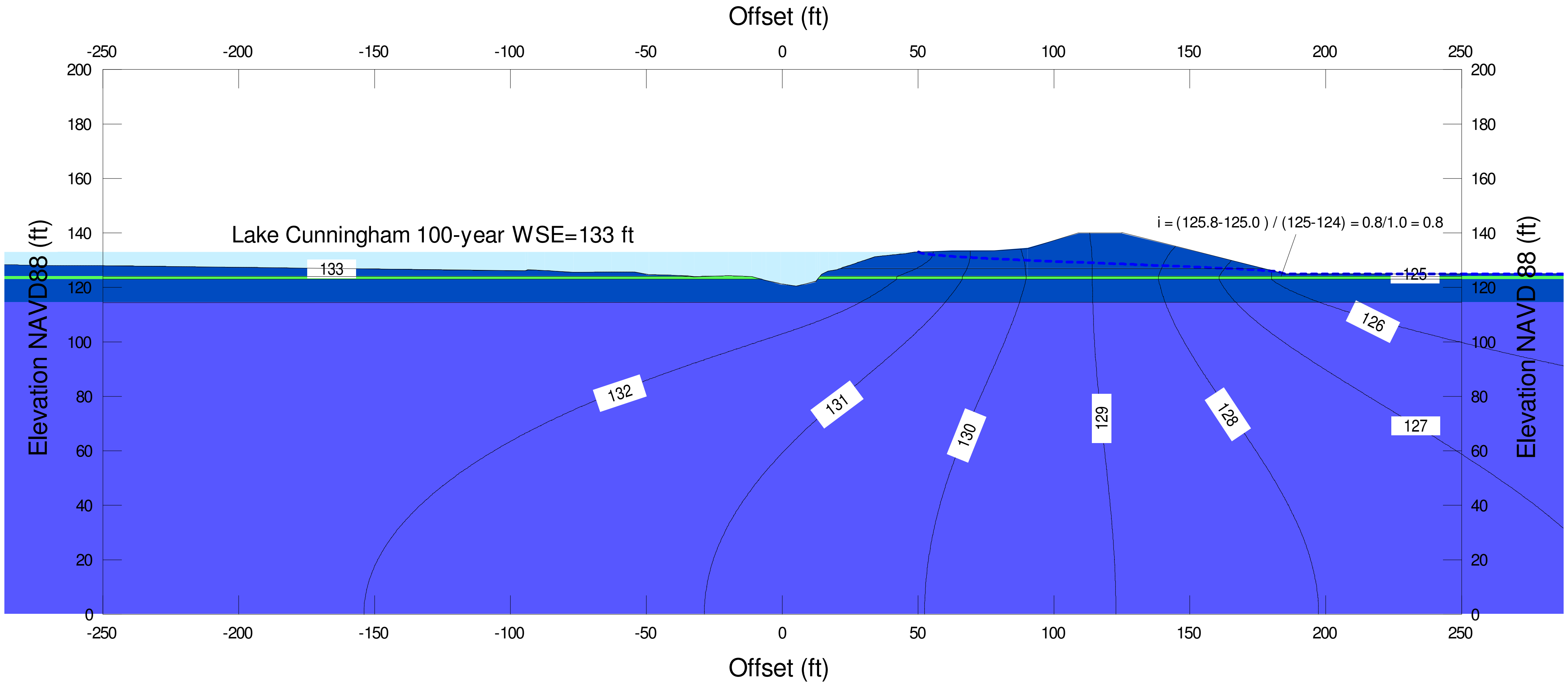
Station 265+90—Lower Silver Creek
Steady State Seepage Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
9

Title: Lake Cunningham - Station 282+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station282+00.gsz
Name: Steady-State Seepage

Name: Lean Clay (CL) Levee Fill   K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)   Ky'/Kx' Ratio: 0.25
Name: Sandy Lean Clay (CL) Levee Fill   K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)   Ky'/Kx' Ratio: 0.25
Name: Silty Sand (SM) Native   K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s)   Ky'/Kx' Ratio: 1
Name: Sandy Lean Clay (CL) Native   K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)   Ky'/Kx' Ratio: 0.25
Name: Fat Clay with Sand (CH) Native   K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)   Ky'/Kx' Ratio: 0.25



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Date:	02/11/2015
FILE NAME:	20150225.002A_SeepSlopeFigures.pub

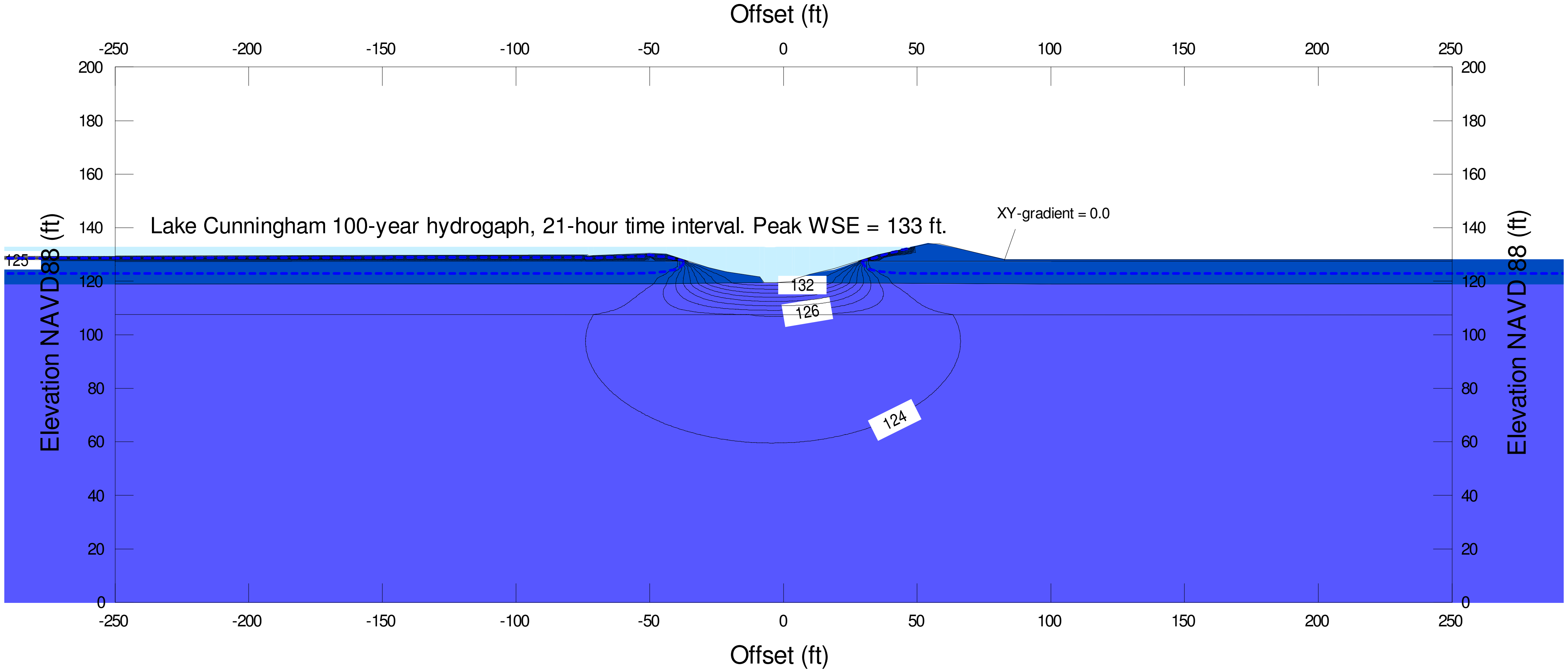
Station 282+00—Lower Silver Creek
Steady State Seepage Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
10

Title: Lake Cunningham - Station 2+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-Transient-Station2+00.gsz
Name: Transient Seepage

Name: Lean Clay with Sand (CL) Levee Fill K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25
Name: Lean Clay with Sand (CL) Native K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25
Name: Fat Clay (CH) Native K-Function: Clay - Levee Embankment Fill Ks=0.0028 ft/day (1.0x10E-6 cm/s) Ky'/Kx' Ratio: 0.25
Name: Fat Clay with Sand (CH) Native K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s) Ky'/Kx' Ratio: 0.25



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FILE NAME:
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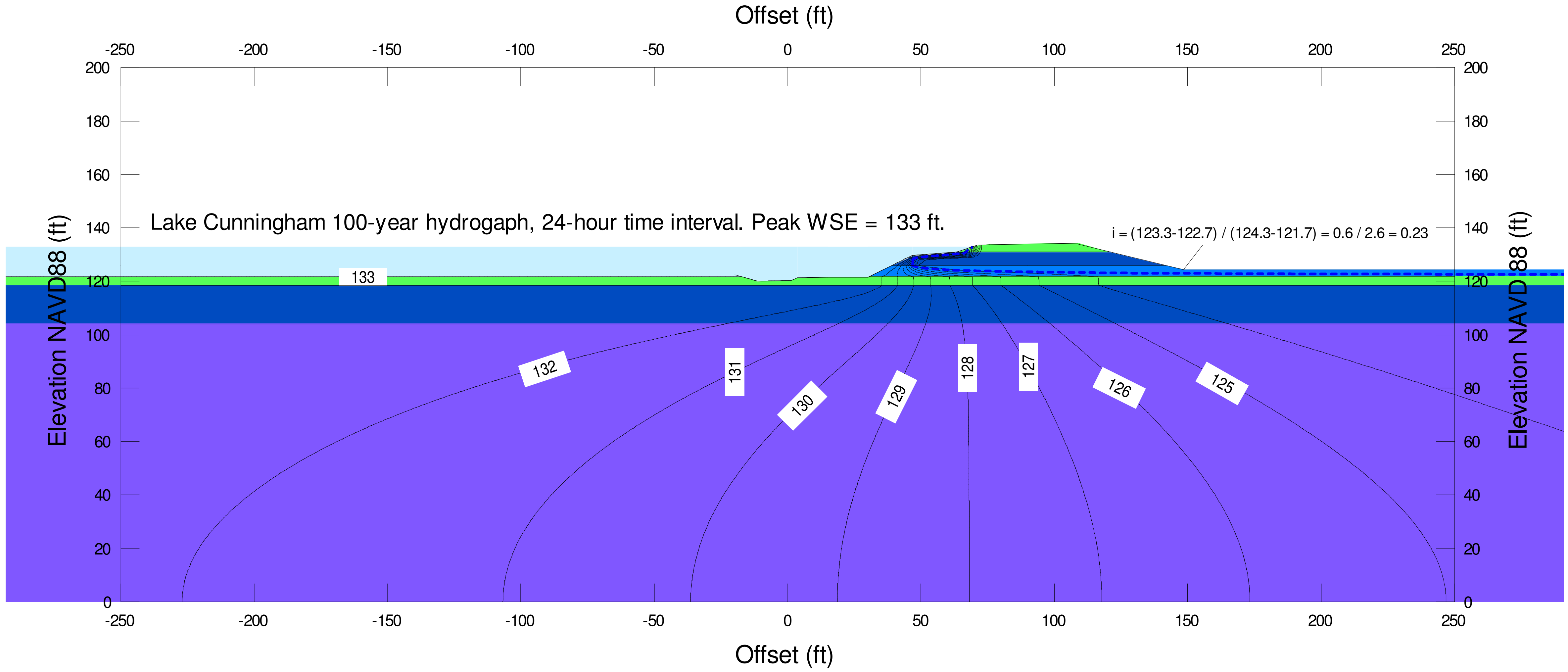
Station 2+00—Flint Creek
Transient Seepage Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
11

Title: Lake Cunningham - Station 250+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-Transient-Station250+00.gsz
Name: Transient Seepage

Name: Silty Sand (SM) Levee Fill	K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Lean Clay with Sand (CL) Levee Fill	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Sandy Lean Clay (CL) Levee Fill	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Silty Sand (SM) Native	K-Function: Silty Sand 13-29% fines, Ks=1.12 ft/day (4.0x10E-4 cm/s)	Ky'/Kx' Ratio: 1
Name: Lean Clay (CL) Native	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25
Name: Fat Clay (CH) Native	K-Function: Clay Blanket Ks=0.028 ft/day (1.0x10E-5 cm/s)	Ky'/Kx' Ratio: 0.25



Lake Cunningham 100-year hydrogaph, 24-hour time interval. Peak WSE = 133 ft.

i = (123.3-122.7) / (124.3-121.7) = 0.6 / 2.6 = 0.23

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DRAWN: M. Beckman
CHECKED BY: M. Fuhriman
Date: 02/11/2015
FILE NAME: 20150225.002A_SeepSlopeFigures.pub

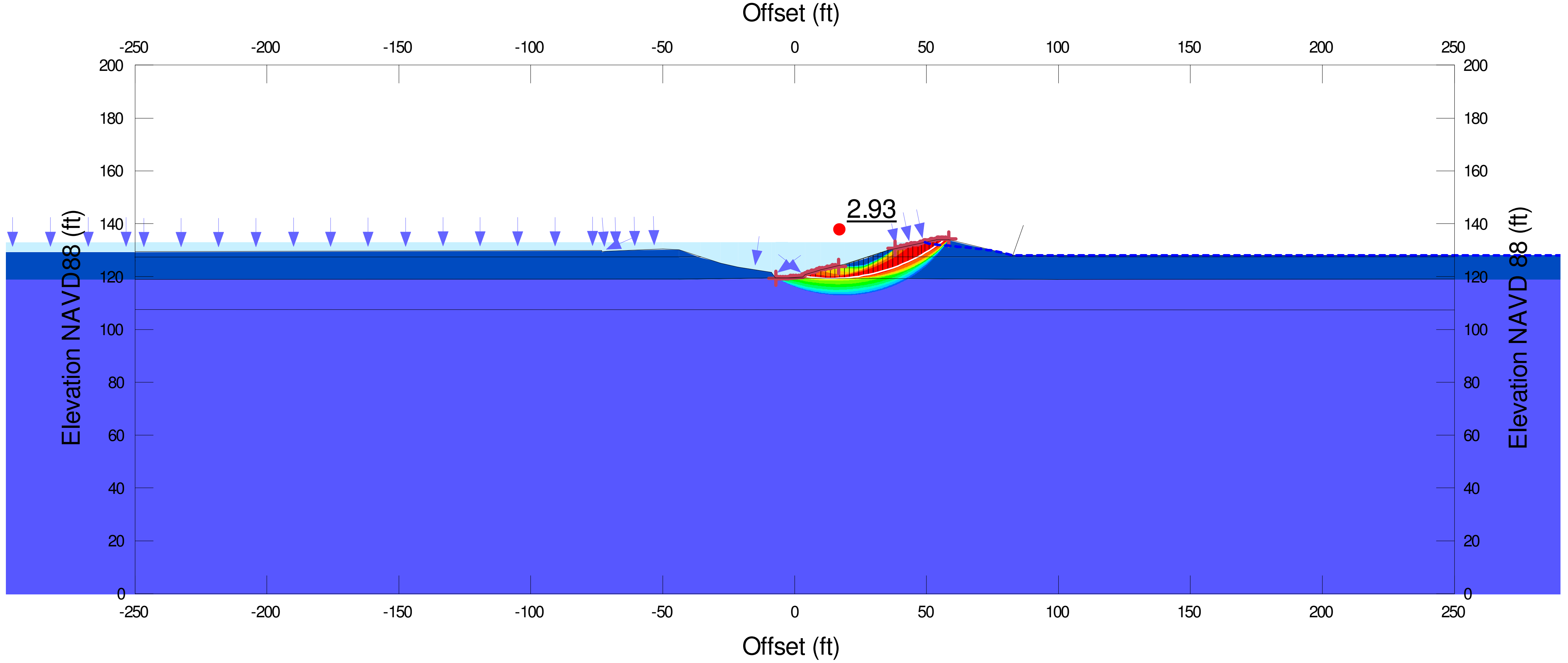
Station 250+00—Lower Silver Creek
Transient Seepage Analysis

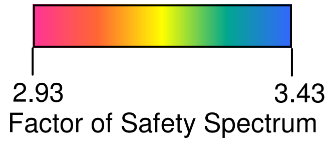
Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
12

Title: Lake Cunningham - Station 2+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station2+00.gsz
Name: Slope Stability

Name: Lean Clay with Sand (CL) Levee Fill   Unit Weight: 130 pcf   Cohesion': 50 psf   Phi': 30 °
Name: Lean Clay with Sand (CL) Native   Unit Weight: 130 pcf   Cohesion': 50 psf   Phi': 28 °
Name: Fat Clay (CH) Native   Unit Weight: 125 pcf   Cohesion': 100 psf   Phi': 28 °
Name: Fat Clay with Sand (CH) Native   Unit Weight: 125 pcf   Cohesion': 100 psf   Phi': 30 °





Factor of Safety Spectrum

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FILE NAME:	20150225.002A_SeepSlopeFigures.pub

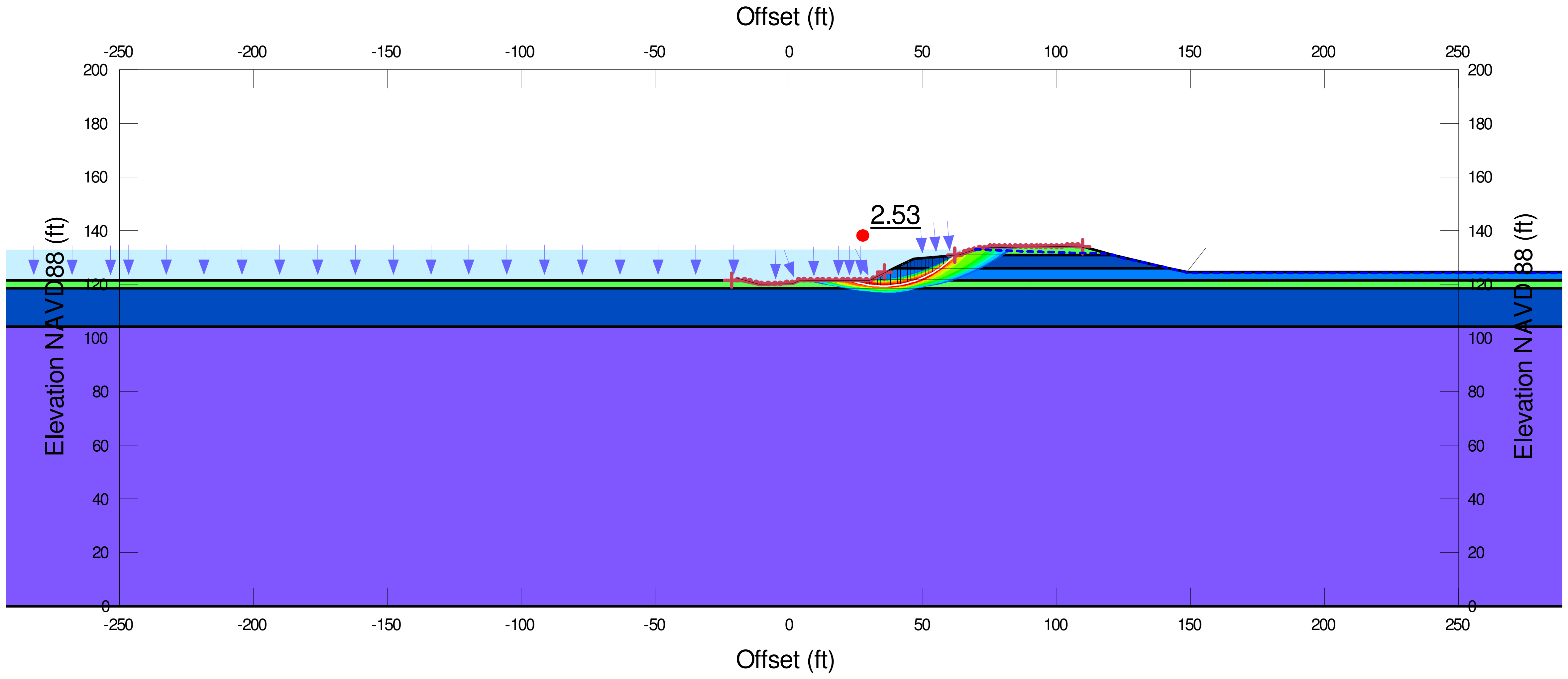
Station 2+00—Flint Creek
Static Stability Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
13

Title: Lake Cunningham - Station 250+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station250+00.gsz
Name: Slope Stability

Name: Silty Sand (SM) Levee Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Lean Clay with Sand (CL) Levee Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 28 °
Name: Sandy Lean Clay (CL) Levee Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 30 °
Name: Silty Sand (SM) Native Unit Weight: 130 pcf Cohesion': 0 psf Phi': 28 °
Name: Lean Clay (CL) Native Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 °
Name: Fat Clay (CH) Native Unit Weight: 125 pcf Cohesion': 100 psf Phi': 30 °



2.53 3.03
Factor of Safety Spectrum

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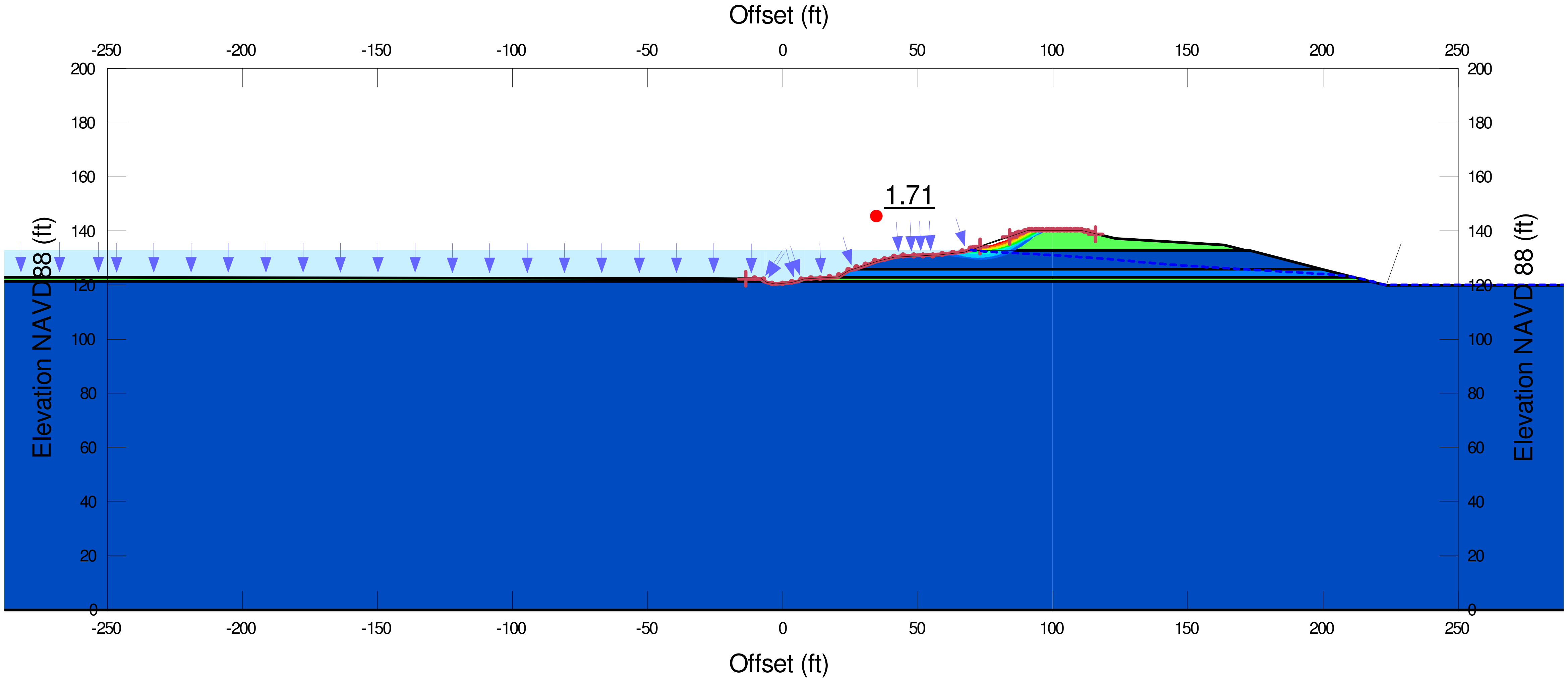
Station 250+00—Lower Silver Creek
Static Stability Analysis

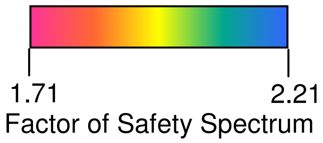
Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
14

Title: Lake Cunningham - Station 265+90
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station265+90.gsz
Name: Slope Stability

Name: Silty Sand (SM) Levee Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Lean Clay with Sand (CL) Levee Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 28 °
Name: Asphalt Concrete (Fill) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Silty Sand (SM) Native Unit Weight: 130 pcf Cohesion': 0 psf Phi': 28 °
Name: Lean Clay (CL) Native Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 °





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Date:	02/11/2015
FILE NAME:	20150225.002A_SeepSlopeFigures.pub

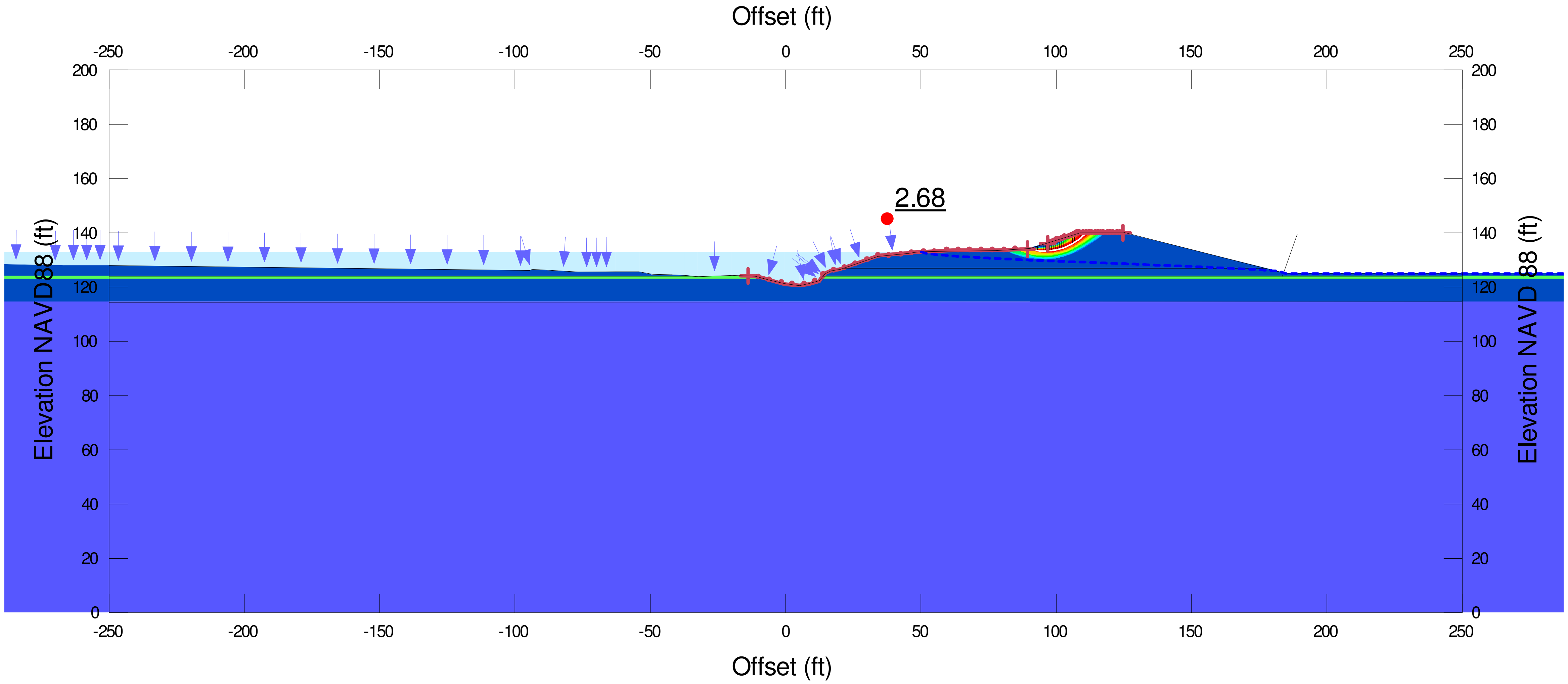
Station 265+90—Lower Silver Creek
Static Stability Analysis

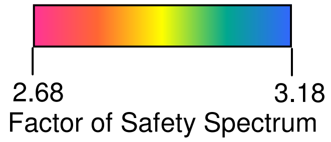
Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
15

Title: Lake Cunningham - Station 282+00
Created By: E. Morley Beckman
Date: 2/10/2015
File Name: 20150225.002A-SeepSlope-Station282+00.gsz
Name: Slope Stability

Name: Lean Clay (CL) Levee Fill   Unit Weight: 130 pcf   Cohesion': 50 psf   Phi': 28 °
Name: Sandy Lean Clay (CL) Levee Fill   Unit Weight: 130 pcf   Cohesion': 50 psf   Phi': 30 °
Name: Silty Sand (SM) Native   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 28 °
Name: Sandy Lean Clay (CL) Native   Unit Weight: 125 pcf   Cohesion': 50 psf   Phi': 30 °
Name: Fat Clay with Sand (CH) Native   Unit Weight: 125 pcf   Cohesion': 100 psf   Phi': 30 °





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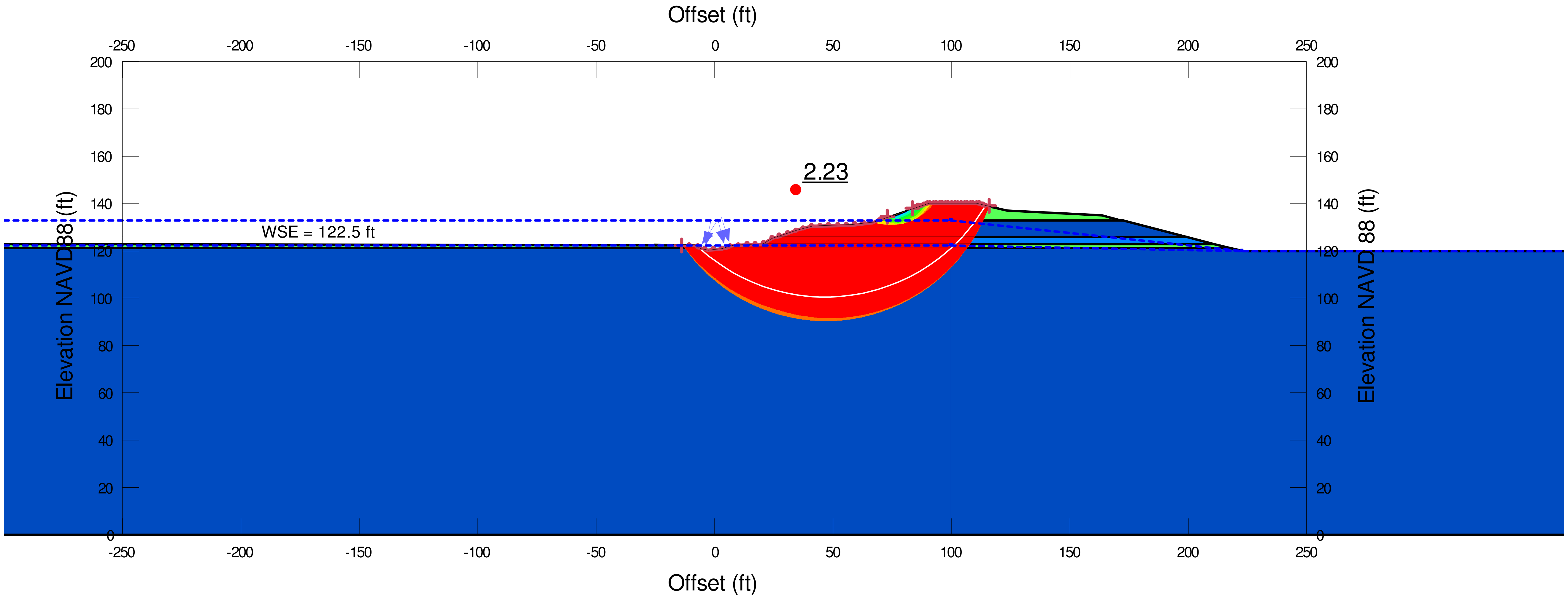
Station 282+00—Lower Silver Creek
Static Stability Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
16

Title: Lake Cunningham - Station 265+90
Created By: E. Morley Beckman
Date: 4/6/2015
File Name: 20150225.002A-RDD-Station265+90 JL.gsz
Name: Slope Stability (Upper RDD)

Name: Silty Sand (SM) Levee Fill Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 ° Total Cohesion: 50 psf Total Phi: 28 °
Name: Lean Clay with Sand (CL) Levee Fill Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 50 psf Phi': 28 ° Total Cohesion: 2,500 psf Total Phi: 0 °
Name: Asphalt Concrete (Fill) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 ° Total Cohesion: 50 psf Total Phi: 28 °
Name: Silty Sand (SM) Native Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 28 ° Total Cohesion: 50 psf Total Phi: 26 °
Name: Lean Clay (CL) Native Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 ° Total Cohesion: 1,000 psf Total Phi: 0 °



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Date: 04/06/2015
FILE NAME: 20150225.002A_SeepSlopeFigures.pub

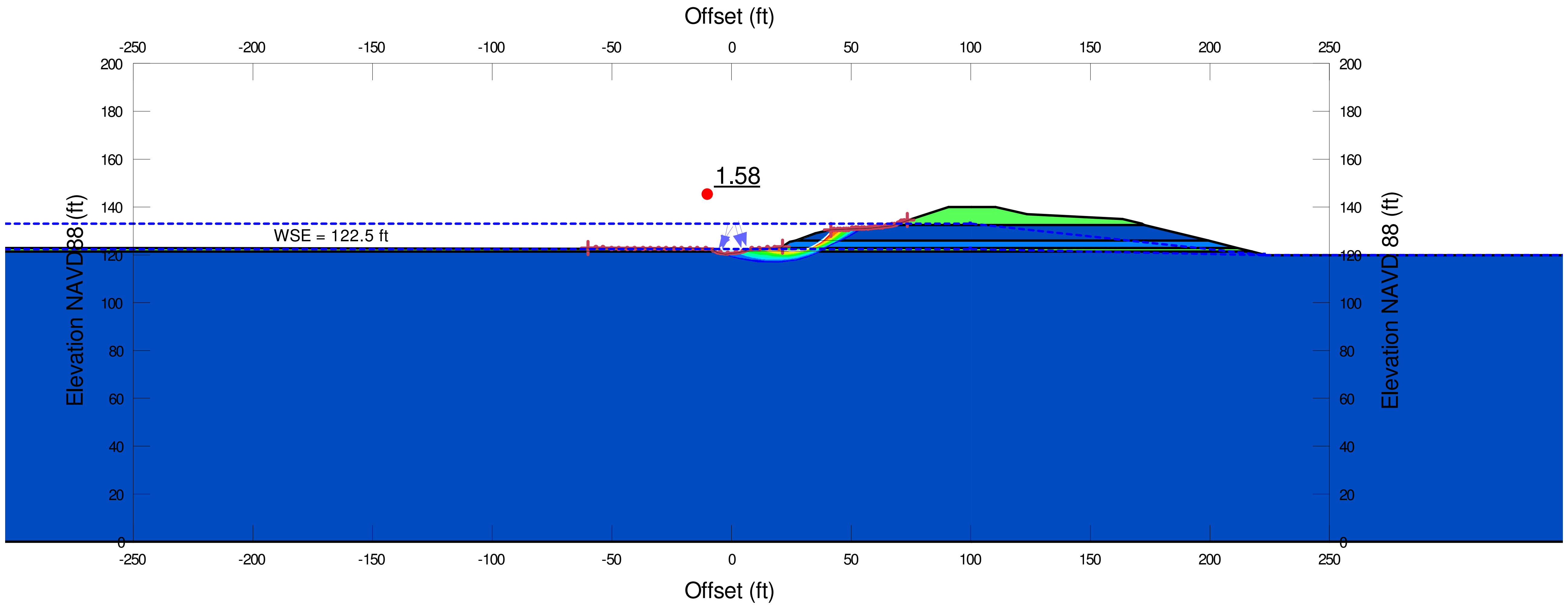
Station 265+90—Lower Silver Creek
Rapid Drawdown Stability Analysis—
Upper Slope

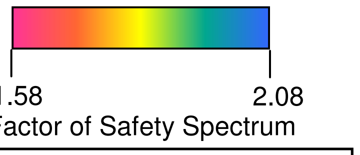
Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
17

Title: Lake Cunningham - Station 265+90
Created By: E. Morley Beckman
Date: 4/6/2015
File Name: 20150225.002A-RDD-Station265+90 JL.gsz
Name: Slope Stability (Lower RDD)

Name: Silty Sand (SM) Levee Fill Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 ° Total Cohesion: 50 psf Total Phi: 28 °
Name: Lean Clay with Sand (CL) Levee Fill Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 50 psf Phi': 28 ° Total Cohesion: 2,500 psf Total Phi: 0 °
Name: Asphalt Concrete (Fill) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 ° Total Cohesion: 50 psf Total Phi: 28 °
Name: Silty Sand (SM) Native Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 28 ° Total Cohesion: 50 psf Total Phi: 26 °
Name: Lean Clay (CL) Native Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 ° Total Cohesion: 1,000 psf Total Phi: 0 °





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Date: 04/06/2015
FILE NAME: 20150225.002A_SeepSlopeFigures.pub

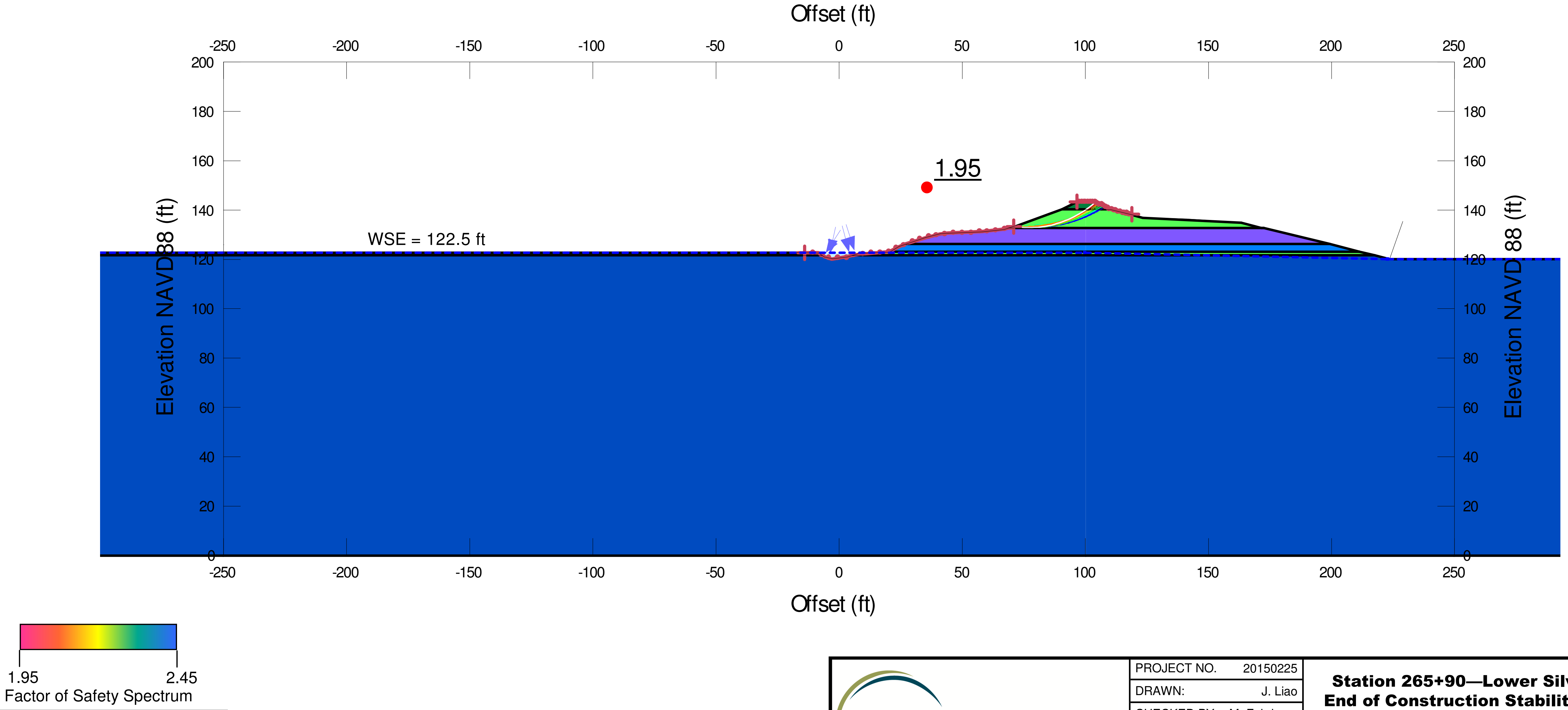
Station 265+90—Silver Creek
Rapid Drawdown Stability Analysis—
Upper Slope

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
18

Title: Lake Cunningham - Station 265+90
Created By: E. Morley Beckman
Date: 4/7/2015
File Name: 20150225.002A-EOC-Station265+90 JL.gsz
Name: Slope Stability End of Construction

Name: Silty Sand (SM) Levee Fill Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Lean Clay with Sand (CL) Levee Fill Model: Undrained (Phi=0) Unit Weight: 130 pcf Cohesion': 1,000 psf
Name: Asphalt Concrete (Fill) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Silty Sand (SM) Native Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 32 °
Name: Lean Clay (CL) Native Model: Undrained (Phi=0) Unit Weight: 125 pcf Cohesion': 1,000 psf
Name: New Levee Fill (SC/SM) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 32 °



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FILE NAME: 20150225.002A_SeepSlopeFigures.pub

Station 265+90—Lower Silver Creek
End of Construction Stability Analysis

Cunningham Flood Detention Facility
Existing Levee Evaluation
San Jose, California

FIGURE
19

APPENDIX A

BORING LOGS AND TEST PIT LOGS

SAMPLE/SAMPLER TYPE GRAPHICS

◧	CALIFORNIA SAMPLER (3 in. (76.2 mm.) outer diameter)
◩	STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

GROUND WATER GRAPHICS

▽	WATER LEVEL (level where first observed)
▼	WATER LEVEL (level after exploration completion)
▼	WATER LEVEL (additional levels after exploration)
≈	OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu≥4 and 1≤Cc≤3	▨	**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/ or 1>Cc>3	▨	**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu≥4 and 1≤Cc≤3	▨	**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				▨	**GW-GC**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/ or 1>Cc>3	▨	**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				▨	**GP-GC**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES		▨	**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
				▨	**GC**	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
				▨	**GC-GM**	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3	▨	**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/ or 1>Cc>3	▨	**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu≥6 and 1≤Cc≤3	▨	**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				▨	**SW-SC**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/ or 1>Cc>3	▨	**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				▨	**SP-SC**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES		▨	**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
				▨	**SC**	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
				▨	**SC-SM**	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	▨	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		▨	**CL**	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		▨	**CL-ML**	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		▨	**OL**	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit greater than 50)	▨	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		▨	**CH**	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		▨	**OH**	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

NOTE: USE MATERIAL DESCRIPTION ON THE LOG TO DEFINE A GRAPHIC THAT MAY NOT BE PROVIDED ON THIS LEGEND.

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DRAWN BY:	AG
CHECKED BY:	CN
DATE:	11/20/2014
REVISED:	-

GRAPHICS KEY

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

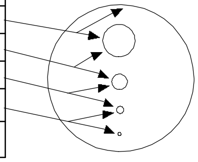
PLATE

A-1

PLOTTED: 04/07/2015 01:38 PM BY: agekas

GRAIN SIZE

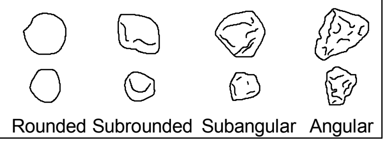
DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #10	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



Munsell Color

NAME	ABBR
Red	R
Yellow Red	YR
Yellow	Y
Green Yellow	GY
Green	G
Blue Green	BG
Blue	B
Purple Blue	PB
Purple	P
Red Purple	RP
Black	N

ANGULARITY

DESCRIPTION	CRITERIA	
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces	
Subangular	Particles are similar to angular description but have rounded edges	
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges	
Rounded	Particles have smoothly curved sides and no edges	

Particles Present

Amount	Percentage
trace	<5
few	5-10
little	15-25
some	30-45
and	50
mostly	50-100

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

NOTE: AFTER TERZAGHI AND PECK, 1948

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (q_u)(psf)	CRITERIA
Very Soft	< 1000	Thumb will penetrate soil more than 1 in. (25 mm.)
Soft	1000 - 2000	Thumb will penetrate soil about 1 in. (25 mm.)
Firm	2000 - 4000	Thumb will indent soil about 1/4-in. (6 mm.)
Hard	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail
Very Hard	> 8000	Thumbnail will not indent soil

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
Homogeneous	Same color and appearance throughout

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

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SOIL DESCRIPTION KEY

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-2

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BORING LOG B-1

Date Begin - End:	11/04/2014	**Drilling Company:**	Exploration Geoservices		
Logged By:	R. Hasseler	**Drill Crew:**	Lorren & Andy		
Hor.-Vert. Datum:	NAVD88	**Drilling Equipment:**	B53	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger	**Hammer Efficiency:**	61%
Weather:	Clear/ warm	**Bore Diameter:**	8" in. O.D.	**Hammer Cal. Date:**	4/05/2013

FIELD EXPLORATION

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 133
Surface Condition: Dirt Road

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		▨	**Lean CLAY (CL)**: yellowish brown, moist, hard, with trace fine sand (LEVEE FILL)											
		▨		▌	BC=11 19 22	100%								
130		▨												
		▨		▌	BC=8 8 8	66%					93			
	5	▨												
		▨	**Sandy Lean CLAY (CL)**: low plasticity, yellowish brown, moist, firm, (NATIVE)	▌	BC=2 3 4 PP=1.25	66%								
125		▨												
		▨		▌	BC=3 4 5 PP=0.25	100%					27			
		░	**Silty SAND (SM)**: fine grained, yellowish brown, moist to wet, loose											
	10	░												
		▨	**Lean CLAY (CL)**: yellowish brown, moist, soft	▌	BC=3 3 3 PP=0.5	66%								
120 ▽		▨	**Sandy Lean CLAY (CL)**: yellowish brown, moist, firm, with fine sand											
		▨		▌	BC=4 7 9 PP=1.5	66%	CL	20.0	110.2		60	24	13	TXUU: Su = 2.1 ksf
	15	▨												
115		▨												
		▩	**Fat CLAY with Sand (CH)**: bluish gray, moist, firm, with fine sand	▌	BC=3 4 5 PP=1.25	83%		27.3	97.6					
	20	▩												
▽		▩												
110		▩												
		▩		▌	BC=5 8 11 PP=0.75	66%		26.3	99.8					CONSOL

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PROJECT NO.:	20150225
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CHECKED BY:	MF
DATE:	11/20/2014
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BORING LOG B-1

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE

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PAGE: 1 of 2

Date Begin - End:	11/04/2014	**Drilling Company:**	Exploration Geoservices		
Logged By:	R. Hasseler	**Drill Crew:**	Lorren & Andy		
Hor.-Vert. Datum:	NAVD88	**Drilling Equipment:**	B53	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger	**Hammer Efficiency:**	61%
Weather:	Clear/ warm	**Bore Diameter:**	8" in. O.D.	**Hammer Cal. Date:**	4/05/2013

BORING LOG B-1

FIELD EXPLORATION

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 133
Surface Condition: Dirt Road

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Fat CLAY with Sand (CH): bluish gray, moist, firm, with fine sand											
105														
	30				BC=5 7 8 PP=2.0	66%		25.8	99.7					
100														
	35				BC=4 7 9 PP=1.5	66%								
95														
	40				BC=6 7 9	100%								
90														
	45													
85														

The boring was terminated at approximately 41.5 ft. below ground surface. The exploration was backfilled with grout on November 04, 2014.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 22 ft. below ground surface during drilling.
▼ Groundwater was observed at approximately 13 ft. below ground surface after drilling completion.

GENERAL NOTES:
Hollow Stem Auger: 0'-25'
Rotary Wash: Below 25' depth

Blow counts show are raw, uncorrected values.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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BORING LOG B-1

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE

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Date Begin - End: 11/04/2014
Logged By: R. Hasseler
Hor.-Vert. Datum: NAVD88
Plunge: -90 degrees
Weather: Clear/ warm

Drilling Company: Exploration Geoservices
Drill Crew: Lorren & Andy
Drilling Equipment: B53
Drilling Method: Hollow Stem Auger
Bore Diameter: 8" in. O.D.

BORING LOG B-2

Hammer Type - Drop: 140 lb. Auto - 30 in.
Hammer Efficiency: 61%
Hammer Cal. Date: 4/05/2013

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 136
Surface Condition: Grass/ Levee

FIELD EXPLORATION							LABORATORY RESULTS							
Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		▨	**Silty SAND (SM)**: fine grained, yellowish brown, moist, medium dense, (LEVEE FILL)											
135				▮	BC=9 9 10	66%								
		▨	**Clayey SAND (SC)**: fine grained, dark brown, moist, loose, (LEVEE FILL)	▮	BC=14 4 8	66%								
	5													
130		▨	**Sandy Lean CLAY (CL)**: dark brown, moist, hard, with fine sand (LEVEE FILL)	▮	BC=4 4 6 PP=3.0	66%		19.9	110.4					TXUU: SU = 2.7 ksf
				▮	BC=6 8 11 PP=2.75	66%		18.9	109.8					
	10													
125			olive brown, moist, firm, mottled	▮	BC=4 7 8 PP=1.25	89%								
		▨	**Lean CLAY (CL)**: olive brown, moist, firm, (NATIVE)	▮	BC=2 4 6 PP=1.25	77%						29 32	13 15	TXCU: C' = 0 0 = 32.7º
	15													
120														
	▼													
		▥	**Sandy SILT to Sandy Clay (CL-ML)**: wet, soft	▮	BC=3 3 6	NR								No recovery, followed with SPT
	20			◩	BC=PUSH	100%								
115														
		▨	**Fat CLAY with Sand (CH)**: olive brown, wet, firm	▮	BC=4 5 6 PP=1.5	100%		23.9	104.8					
	▽													

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BORING LOG B-2

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
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BORING LOG B-2

Date Begin - End:	11/04/2014	**Drilling Company:**	Exploration Geoservices		
Logged By:	R. Hasseler	**Drill Crew:**	Lorren & Andy		
Hor.-Vert. Datum:	NAVD88	**Drilling Equipment:**	B53	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger	**Hammer Efficiency:**	61%
Weather:	Clear/ warm	**Bore Diameter:**	8" in. O.D.	**Hammer Cal. Date:**	4/05/2013

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 136
Surface Condition: Grass/ Levee

			FIELD EXPLORATION				LABORATORY RESULTS							
Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
110		▨	**Fat CLAY with Sand (CH)**: olive brown, wet, firm											
105	30	▨	moist	■	BC=8 11 12 PP=4.25	89%		14.6	123.8					
100	35	▨		■	BC=4 5 8 PP=1.25	72%								
95	40	▨		■	BC=5 6 8 PP=1.5	100%		26.9	98.7					
90	45													

The boring was terminated at approximately 41.5 ft. below ground surface. The exploration was backfilled with grout on November 04, 2014.

GROUNDWATER LEVEL INFORMATION:

▽ Groundwater was observed at approximately 25 ft. below ground surface during drilling.

▼ Groundwater was observed at approximately 17.5 ft. below ground surface after drilling completion.

GENERAL NOTES:

Hollow Stem Auger: 0'-26'
Rotary Wash: Below 26' depth

Blow counts show are raw, uncorrected values.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

PROJECT NO.: 20150225	BORING LOG B-2	PLATE
DRAWN BY: AG		A-4
CHECKED BY: MF	CUNNINGHAM FLOOD DETENTION FACILITY EXISTING LEVEE EVALUATION SAN JOSE, CALIFORNIA	
DATE: 11/20/2014		
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Date Begin - End:	11/05/2014	**Drilling Company:**	Exploration Geoservices		**BORING LOG B-3**
Logged By:	R. Hasseler	**Drill Crew:**	Lorren & Andy		
Hor.-Vert. Datum:	NAVD88	**Drilling Equipment:**	B53	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger	**Hammer Efficiency:**	61%
Weather:	Clear/ warm	**Bore Diameter:**	8" in. O.D.	**Hammer Cal. Date:**	4/05/2013

FIELD EXPLORATION

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 140
Surface Condition: Grass/ Levee

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Silty SAND (SM): fine grained, yellowish brown, moist, medium dense, (LEVEE FILL)											
			■	BC=6 10 11	66%								
		Silty SAND (SM): yellowish brown, moist, medium dense, fine to coarse sand with trace fine gravel (LEVEE FILL)											
			■	BC=8 11 21	66%				97	40			SIEVE
135	5												
			■	BC=6 11 13	100%								
		Lean CLAY with Sand (CL): dark brown, moist, hard to firm (LEVEE FILL)											
			■	BC=4 6 10 PP=3.5	100%								
130	10												
			■	BC=4 5 13 PP=2.5	66%					71			
			■	BC=8 6 8 PP=3.5 >4.5	100%								
		Asphalt concrete											
125	15												
		asphalt chunks	■	BC=15 8 10 PP=>4.5	66%								
		Silty SAND (SM): fine grained, yellowish brown, moist, medium dense, some gravels (FILL)											
		Lean CLAY (CL): dark brown, moist, hard, with roots to 20' (NATIVE)	■	BC=4 6 11 PP=>4.5	100%								
120	20	firm, yellowish brown below 20'											
			■	BC=1 3 6 PP=1.5	100%		23.9	103.0					TXUU: Su = 0.69 ksf

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BORING LOG B-3

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE

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Date Begin - End: 11/05/2014
Logged By: R. Hasseler
Hor.-Vert. Datum: NAVD88
Plunge: -90 degrees
Weather: Clear/ warm

Drilling Company: Exploration Geoservices
Drill Crew: Lorren & Andy
Drilling Equipment: B53
Drilling Method: Hollow Stem Auger
Bore Diameter: 8" in. O.D.

BORING LOG B-3

Hammer Type - Drop: 140 lb. Auto - 30 in.
Hammer Efficiency: 61%
Hammer Cal. Date: 4/05/2013

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 140
Surface Condition: Grass/ Levee

			FIELD EXPLORATION				LABORATORY RESULTS							
Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		▨	**Lean CLAY (CL)**: yellowish brown, moist, firm, (NATIVE)											
	▼	▨												
	▽	▨		■	BC=3 4 6 PP=2.0	75%		30.5	94.2					
110	30	▨												
105	35	▨		■	BC=7 9 14 PP=3.5	100%								
100	40	▨		■	BC=9 8 9 PP=2.25	100%								
95	45													

The boring was terminated at approximately 41.5 ft. below ground surface. The exploration was backfilled with grout on November 05, 2014.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 28.5 ft. below ground surface during drilling.
▼ Groundwater was observed at approximately 27 ft. below ground surface after drilling completion.
GENERAL NOTES:
Hollow Stem Auger: 0'-30'
Rotary Wash: Below 30' depth

Blow counts show are raw, uncorrected values.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.: 20150225
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BORING LOG B-3

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
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BORING LOG B-4

Date Begin - End: 11/03/2014
Logged By: R. Hasseler
Hor.-Vert. Datum: NAVD88
Plunge: -90 degrees
Weather: Clear/ mild
Drilling Company: Exploration Geoservices
Drill Crew: Lorren & Andy
Drilling Equipment: B53
Drilling Method: Hollow Stem Auger
Bore Diameter: 8" in. O.D.
Hammer Type - Drop: 140 lb. Auto - 30 in.
Hammer Efficiency: 61%
Hammer Cal. Date: 4/05/2013

FIELD EXPLORATION

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 134
Surface Condition: Grass/ Levee

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty SAND (SM): fine grained, yellowish brown, moist, medium dense, (LEVEE FILL)											
					BC=5 9 12 PP=N/R	66%								
			Lean CLAY with Sand (CL): yellowish brown, moist, hard, (LEVEE FILL)											
130					BC=7 10 12 PP=N/R	77%					78			
	5													
					BC=6 10 11 PP=N/R	77%								
			Sandy Lean CLAY (CL): dark brown, moist, hard, (NATIVE)											
125					BC=4 9 11 PP=>4.5	77%		18.2	109.3					
	10													
					BC=3 4 5	100%								
			Silty SAND (SM): fine grained, grayish brown, wet, loose											
120			**Lean CLAY (CL)**: brown, moist, soft		BC=2 1 2 PP=1.5 1.75	100%								
▽▼	15		**Silty SAND (SM)**: fine grained, brown, wet, loose											
			Lean CLAY (CL): brown, wet, soft		BC=1 1 1	100%								
115														
	20		firm below 20'		BC=3 4 4 PP=1.25	100%						41	17	TXCU: C' = 0 0 = 32.0º
110														

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PROJECT NO.: 20150225
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DATE: 11/20/2014
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BORING LOG B-4

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE

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Date Begin - End: 11/03/2014
Drilling Company: Exploration Geoservices
BORING LOG B-4
Logged By: R. Hasseler
Drill Crew: Lorren & Andy
Hor.-Vert. Datum: NAVD88
Drilling Equipment: B53
Hammer Type - Drop: 140 lb. Auto - 30 in.
Plunge: -90 degrees
Drilling Method: Hollow Stem Auger
Hammer Efficiency: 61%
Weather: Clear/ mild
Bore Diameter: 8" in. O.D.
Hammer Cal. Date: 4/05/2013

FIELD EXPLORATION

Latitude: ° N
Longitude: ° W
Approximate Ground Surface Elevation (ft.): 134
Surface Condition: Grass/ Levee

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		▨	**Lean CLAY (CL)**: brown, wet, firm	■	BC=4 7 8 PP=0.25	33%		26.7	98.4					CONSOL TXUU: Su = 0.32 ksf
105		▨												
	30	▨	**Fat CLAY with Sand (CH)**: bluish gray, wet, soft to firm, with fine sand	■	BC=4 4 7 PP=1.0	66%		34.0	98.2					
100		▨												
	35	▨		■	BC=6 8 10 PP=0.5	61%		25.1	101.4					
		▨	dark gray, firm, with organics below 35'											
95		▨												
	40	▨												
		▨		■	BC=5 4 4	100%								
		▨		◣	BC=4 4 4	100%								
		▨	**Fine CLAY with Sand (CH)**: light grayish brown to white, moist, soft, with fine to coarse sand											
90														
	45													
85														

The boring was terminated at approximately 44 ft. below ground surface. The exploration was backfilled with grout on November 03, 2014.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 14.8 ft. below ground surface during drilling.
▼ Groundwater was observed at approximately 14.8 ft. below ground surface after drilling completion.

GENERAL NOTES:
Hollow Stem Auger: 0'-15'
Rotary Wash: Below 15' depth

Blow counts show are raw, uncorrected values.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.: 20150225
DRAWN BY: AG
CHECKED BY: MF
DATE: 11/20/2014
REVISED: -

BORING LOG B-4

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-6

BORING LOG B-5

Date Begin - End:	11/05/2014	**Drilling Company:**	Exploration Geoservices		
Logged By:	R. Hasseler	**Drill Crew:**	Lorren & Andy		
Hor.-Vert. Datum:	NAVD88	**Drilling Equipment:**	B53	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger	**Hammer Efficiency:**	61%
Weather:	Clear/ warm	**Bore Diameter:**	8" in. O.D.	**Hammer Cal. Date:**	4/05/2013

FIELD EXPLORATION | LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 134
Surface Condition: Plant Debris/ Soil

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		▨	**Lean CLAY with Sand (CL)**: brown, moist, firm, (FILL)	■	BC=8 11 10	77%					81			
130		▨	**Lean CLAY with Sand (CL)**: yellow brown, moist, hard, with fine sand (NATIVE)	■	BC=5 8 10 PP=>4.5	72%								
	5	▨		■	BC=4 6 9 PP=3.75	55%		13.4	109.3					
125		▨		■	BC=4 5 6 PP=3.0	100%								
	10	▨	black	■	BC=3 2 2 PP=1.5	77%								
		▧	**Fat CLAY (CH)**: olive brown, moist, soft											
120		▧		■	BC=1 3 3 PP=1.25	77%		35.4	86.1					CONSOL
	15	▧												
	▼	▧												
115		▧	dark gray below 19'	■	BC=3 4 7 PP=1.5	77%		31.9	90.1					TXUU: Su = 1.6 ksf
	20	▧												
110		▧	**Fat CLAY with Sand (CH)**: light brown to white, moist, soft, with fine sand	■	BC=5 6 6 PP=2.25	100%								
▽														

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Bright People. Right Solutions.

PROJECT NO.:	20150225
DRAWN BY:	AG
CHECKED BY:	MF
DATE:	11/20/2014
REVISED:	-

BORING LOG B-5

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-7

PAGE: 1 of 2

gINT FILE: C:\users\agekas\documents\__all Cadd-Documents__cad-Work In Progress\20150225_lake Cunningham Berms\20150225-Lake Cunningham.gpj
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gINT TEMPLATE: C:KLF_STANDARD_GINT_LIBRARY_2015.GLB [KLF_BORING/TEST PIT SOIL LOG]

BORING LOG B-5

Date Begin - End:	11/05/2014	**Drilling Company:**	Exploration Geoservices		
Logged By:	R. Hasseler	**Drill Crew:**	Lorren & Andy		
Hor.-Vert. Datum:	NAVD88	**Drilling Equipment:**	B53	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger	**Hammer Efficiency:**	61%
Weather:	Clear/ warm	**Bore Diameter:**	8" in. O.D.	**Hammer Cal. Date:**	4/05/2013

Approximate Ground Surface Elevation (ft.): 134
Surface Condition: Plant Debris/ Soil

			FIELD EXPLORATION				LABORATORY RESULTS							
Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		▨	**Fat CLAY with Sand (CH)**: light brown to white, moist, soft, with fine sand											
105		▨												
	30	▨		■	BC=4 4 7 PP=1.75	100%		27.7	96.8					
100		▨												
	35	▨		■	BC=4 7 9 PP=1.5	100%								
95		▨												
	40	▨		■	BC=5 8 10 PP=2.0	100%								
90														
	45													
85														

The boring was terminated at approximately 41.5 ft. below ground surface. The exploration was backfilled with grout on November 05, 2014.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 25 ft. below ground surface during drilling.
▼ Groundwater was observed at approximately 17 ft. below ground surface after drilling completion.
GENERAL NOTES:
Hollow Stem Auger: 0'-26'
Rotary Wash: Below 26' depth

Blow counts show are raw, uncorrected values.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.:	20150225	BORING LOG B-5	PLATE
DRAWN BY:	AG		
CHECKED BY:	MF	CUNNINGHAM FLOOD DETENTION FACILITY EXISTING LEVEE EVALUATION SAN JOSE, CALIFORNIA	A-7
DATE:	11/20/2014		
REVISED:	-		PAGE: 2 of 2

PLOTTED: 04/07/2015 01:36 PM BY: agekas

Date Begin - End:	11/06/2014	**Drilling Company:**	Exploration Geoservices		**BORING LOG B-6**
Logged By:	R. Hasseler	**Drill Crew:**	Lorren & Andy		
Hor.-Vert. Datum:	NAVD88	**Drilling Equipment:**	B53	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger	**Hammer Efficiency:**	61%
Weather:	Partly cloudy/ warm	**Bore Diameter:**	8" in. O.D.	**Hammer Cal. Date:**	4/05/2013

FIELD EXPLORATION | LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 134
Surface Condition: Plant Debris/ Soil

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Silty SAND (SM): fine grained, yellowish brown, moist, with plant debris (FILL)											
		Sandy Lean CLAY (CL): dark brown, moist, hard, (FILL)	■	BC=5 7 9 PP=>4.5	100%		15.4	112.3					
130		**Clayey SAND (SC)**: fine grained, brown, moist, medium dense, (FILL)	■	BC=7 8 8	89%								
	5												
		Lean CLAY (CL): low plasticity, dark brown to black, moist, hard, (NATIVE)	■	BC=8 11 13 PP=>4.5	72%								
			■	BC=6 9 12 PP=4.5	89%								
125		**Fat CLAY with Sand (CH)**: light brown, olive brown mottled, moist, hard											
	10												
	▼												
		dark gray to bluish gray, 12'-19'	■	BC=5 8 10 PP=4.0	100%		17.8	99.5					
120			■	BC=5 8 11 PP=4.0	100%	CH				75	52	34	
	15												
115		yellowish brown below 19'	■	BC=5 7 9 PP=3.0	89%		23.3	99.3					
	▽ 20												
		Clayey SAND (SC): fine to medium grained, yellowish brown, wet											
110													
	25		■	BC=4 6 9 PP=3.0	100%		20.6	106.9					
		Lean CLAY (CL): yellowish brown, moist to wet, hard											
105													
	30		■	BC=7 9 12 PP=3.25	100%								
100													

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PROJECT NO.: 20150225	BORING LOG B-6		PLATE
DRAWN BY:			
CHECKED BY:	CUNNINGHAM FLOOD DETENTION FACILITY EXISTING LEVEE EVALUATION SAN JOSE, CALIFORNIA		A-8
DATE:			
REVISED: -			PAGE: 1 of 2

Date Begin - End: 11/06/2014
Logged By: R. Hasseler
Hor.-Vert. Datum: NAVD88
Plunge: -90 degrees
Weather: Partly cloudy/ warm
Drilling Company: Exploration Geoservices
Drill Crew: Lorren & Andy
Drilling Equipment: B53
Drilling Method: Hollow Stem Auger
Bore Diameter: 8" in. O.D.
Hammer Type - Drop: 140 lb. Auto - 30 in.
Hammer Efficiency: 61%
Hammer Cal. Date: 4/05/2013

BORING LOG B-6

			FIELD EXPLORATION				LABORATORY RESULTS							
Approximate Elevation (feet)	Depth (feet)	Graphical Log	Approximate Ground Surface Elevation (ft.): 134 Surface Condition: Plant Debris/ Soil Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		▨	**Lean CLAY (CL)**: yellowish brown, moist to wet, hard	■	BC=7 9 10 PP=2.0	100%								
95		▨												
	40	▨		■	BC=8 12 23 PP=4.0	33%								
90														
	45													
85														
	50													
80														
	55													
75														
	60													
70														
	65													
65														

The boring was terminated at approximately 41.5 ft. below ground surface. The exploration was backfilled with grout on November 06, 2014.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 20 ft. below ground surface during drilling.
▼ Groundwater was observed at approximately 11 ft. below ground surface after drilling completion.

GENERAL NOTES:
Hollow Stem Auger was used to drill to terminated depth

Blow counts show are raw, uncorrected values.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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DATE:
REVISED: -

BORING LOG B-6

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-8

PAGE: 2 of 2

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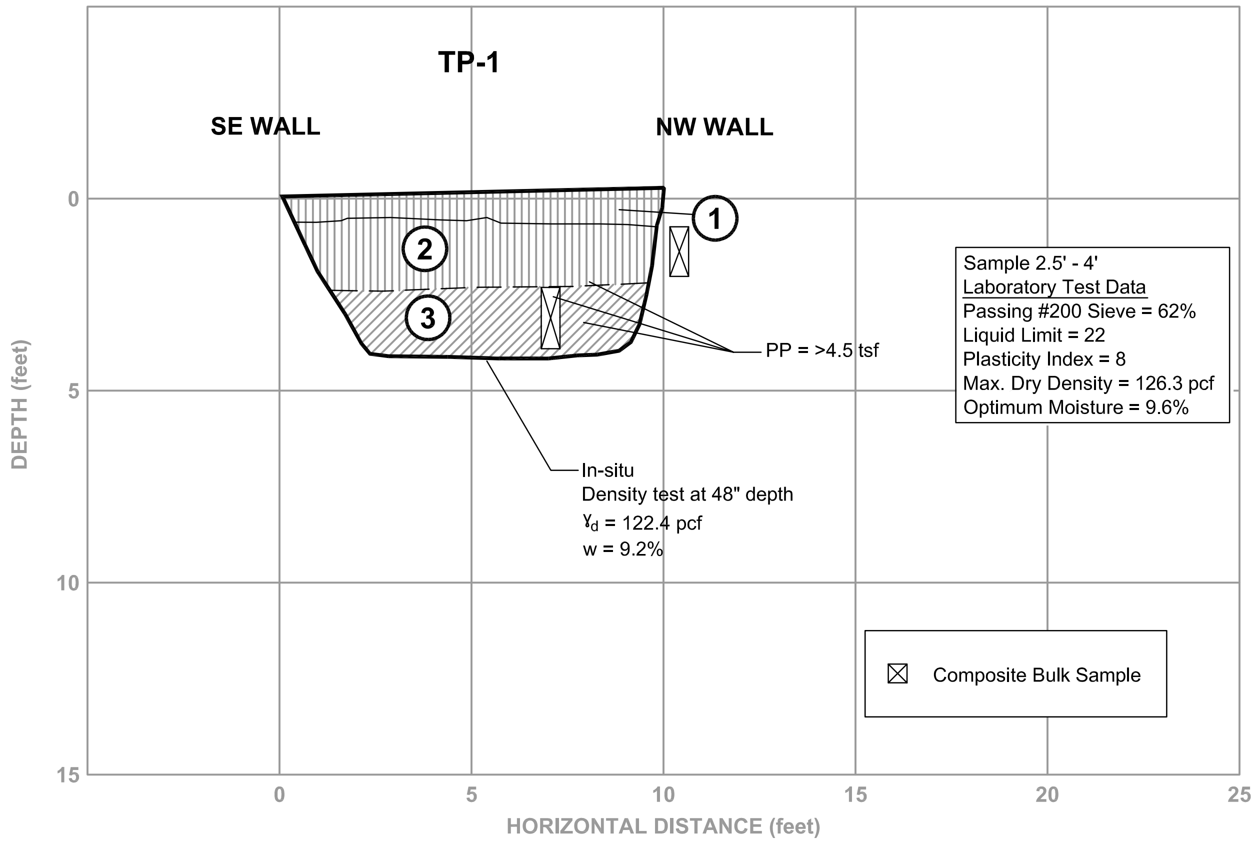

Sample 2.5' - 4'
Laboratory Test Data
Passing #200 Sieve = 62%
Liquid Limit = 22
Plasticity Index = 8
Max. Dry Density = 126.3 pcf
Optimum Moisture = 9.6%

In-situ
Density test at 48" depth
γ_d = 122.4 pcf
w = 9.2%

☒ Composite Bulk Sample

UNIT NO.	MATERIALS DESCRIPTION
①	SANDY SILT (ML) - yellowish brown, dry to moist, fine-grained sand, with grass and rootlets
②	SILT (ML) - brown, dry, with clay, increasing clay content decreasing sand content with depth
③	SANDY LEAN CLAY (CL) - olive brown, dry to moist, hard, fine-grained sand
	NOTE: Groundwater not encountered.

LOGGED BY: Minh Nguyen **DATE:** 11/7/2014 **ELEVATION:** 140 Feet (Approx.)

EQUIPMENT: Backhoe with 24" bucket

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K-TEST PITS.dwg

LOG OF TEST PIT
TP-1

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-9

PLOTTED: 07 Apr 2015, 1:23pm, agekas
LAYOUT: TP-1
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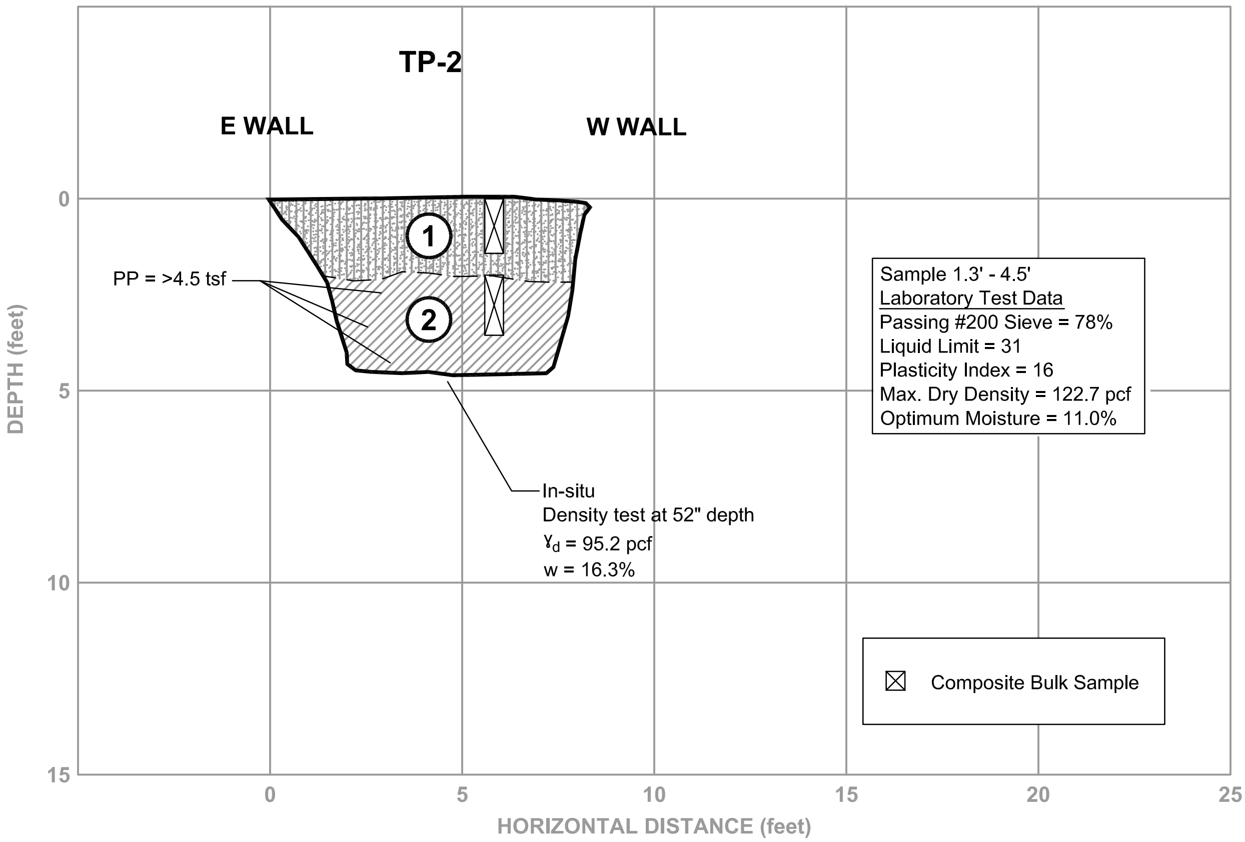
ATTACHED XREFS:
OAKLAND, CA



In-situ
Density test at 52" depth
γ_d = 95.2 pcf
w = 16.3%

Sample 1.3' - 4.5'
Laboratory Test Data
Passing #200 Sieve = 78%
Liquid Limit = 31
Plasticity Index = 16
Max. Dry Density = 122.7 pcf
Optimum Moisture = 11.0%

UNIT NO.	MATERIALS DESCRIPTION
①	SILTY SAND (SM) - brown, dry, fine-grained sand
②	LEAN CLAY WITH SAND (CL) - olive brown, moist, hard, fine-grained sand
	NOTE: Groundwater not encountered.

LOGGED BY: Minh Nguyen

DATE: 11/7/2014

ELEVATION: 136 Feet (Approx.)

EQUIPMENT: Backhoe with 24" bucket

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LOG OF TEST PIT
TP-2

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-10

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LAYOUT: TP-2
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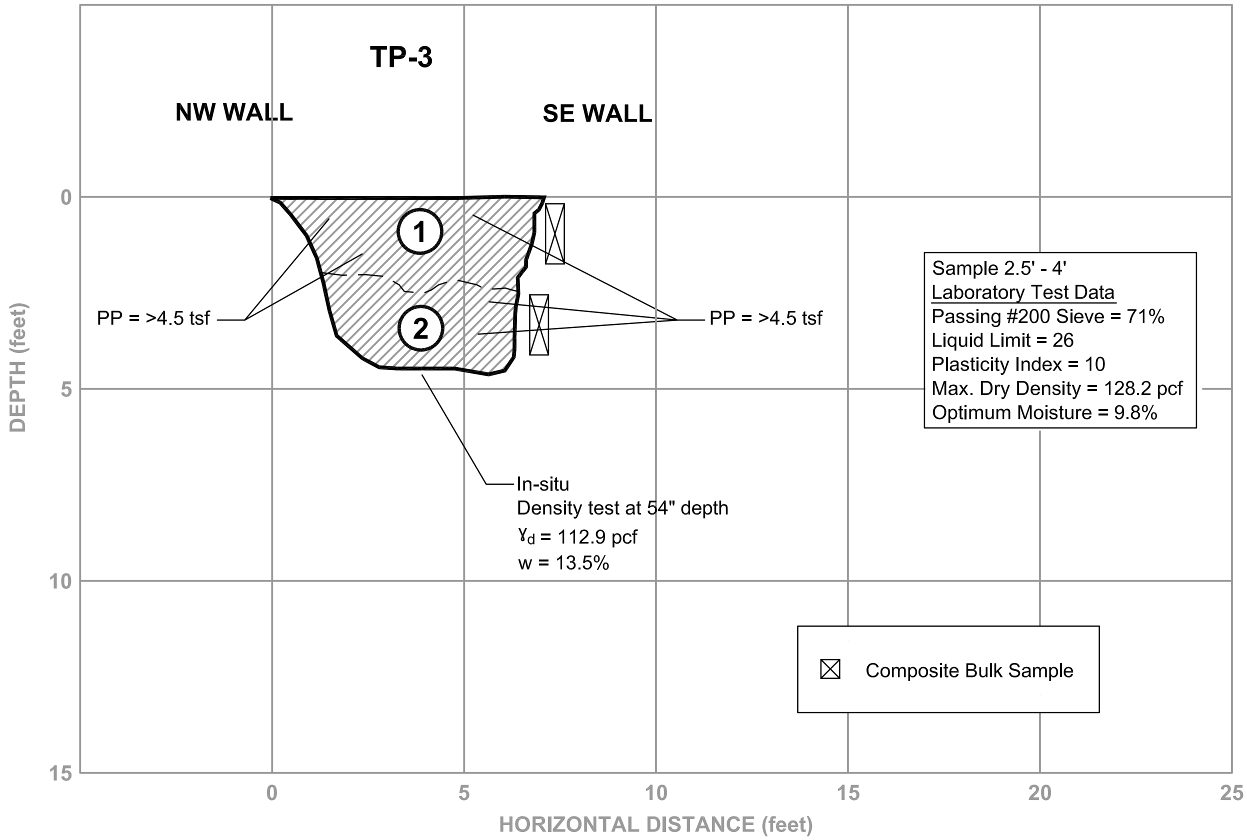
OAKLAND, CA



Sample 2.5' - 4'
Laboratory Test Data
Passing #200 Sieve = 71%
Liquid Limit = 26
Plasticity Index = 10
Max. Dry Density = 128.2 pcf
Optimum Moisture = 9.8%

In-situ
Density test at 54" depth
γ_d = 112.9 pcf
w = 13.5%

☒ Composite Bulk Sample

UNIT NO.	MATERIALS DESCRIPTION
①	LEAN CLAY (CL) - olive brown, dry, low plasticity, hard, desicated with cracks ranging between 1/8" to 1/2" deep, grass rootlets
②	LEAN CLAY WITH SAND (CL) - olive brown, moist, hard, fine-grained sand
	NOTE: Groundwater not encountered.

LOGGED BY: Minh Nguyen
DATE: 11/7/2014
ELEVATION: 134 Feet (Approx.)

EQUIPMENT: Backhoe with 24" bucket

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LOG OF TEST PIT TP-3

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-11

PLOTTED: 07 Apr 2015, 1:24pm, agekas
LAYOUT: TP-3
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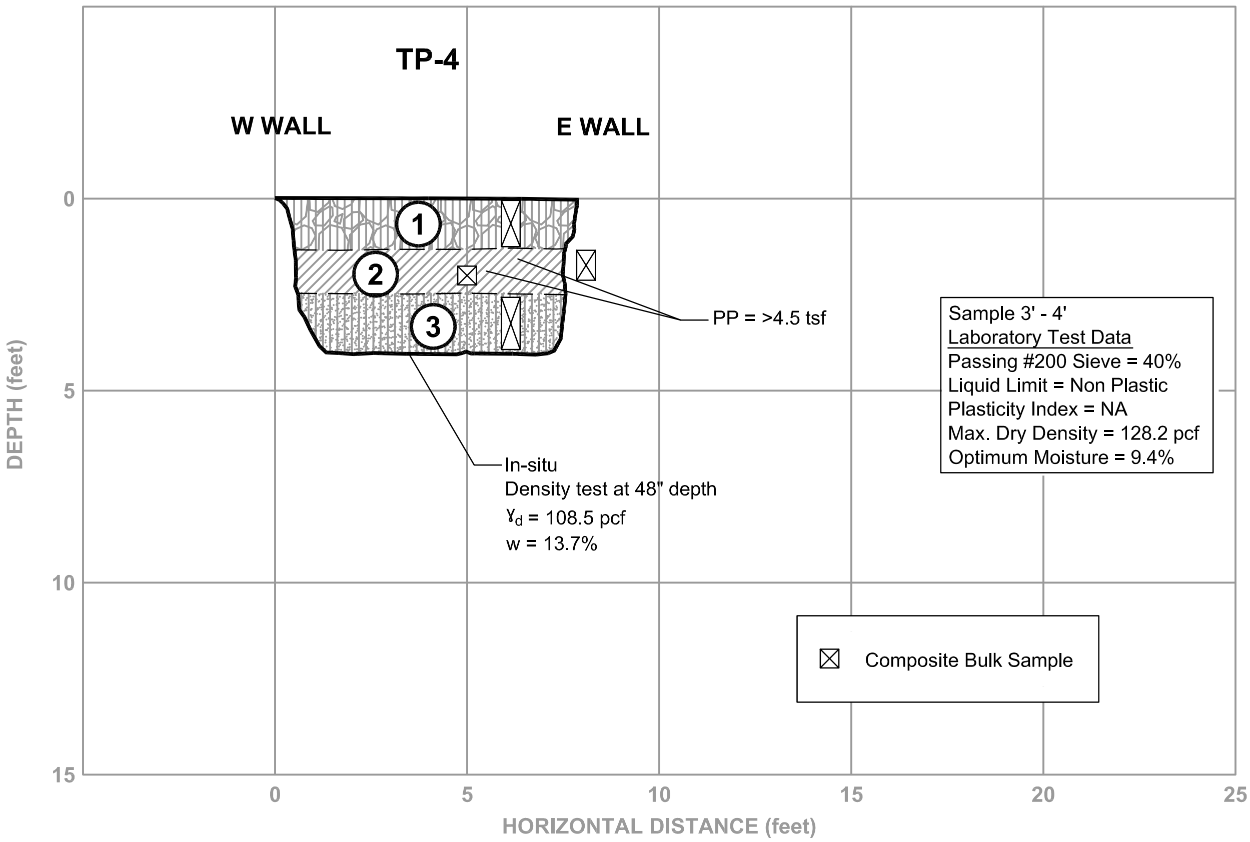

Sample 3' - 4'
Laboratory Test Data
Passing #200 Sieve = 40%
Liquid Limit = Non Plastic
Plasticity Index = NA
Max. Dry Density = 128.2 pcf
Optimum Moisture = 9.4%

UNIT NO.	MATERIALS DESCRIPTION
①	SILTY GRAVEL WITH SAND (GM) - yellowish brown to brown, dry, average gravel size 3/4", maximum gravel size 3", hard, 3" to 4" stratified layers of silty sand and poorly graded gravels, fine to coarse sand
②	LEAN CLAY WITH SAND (CL) - olive brown, moist, hard, fine-grained sand
③	SILTY SAND (SM) - yellowish brown, moist, rounded to subrounded fine-grained sand, silts

NOTE:
Groundwater not encountered.

LOGGED BY: Minh Nguyen
DATE: 11/7/2014
ELEVATION: 134 Feet (Approx.)
EQUIPMENT: Backhoe with 24" bucket

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K-TEST PITS.dwg

LOG OF TEST PIT
TP-4

CUNNINGHAM FLOOD DETENTION FACILITY
EXISTING LEVEE EVALUATION
SAN JOSE, CALIFORNIA

PLATE
A-12

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LAYOUT: TP-4
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ATTACHED XREFS:
OAKLAND, CA

02103N1 (16080)

NON-HAZARDOUS WASTE MANIFEST	1. Generator ID Number N/A	2. Page 1 of 1	3. Emergency Response Phone 707-751-3817	**4. Waste Tracking Number** NH-KLE1409-121014-001

5. Generator's Name and Mailing Address
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118
Generator's Phone: (408) 265-2600

Generator's Site Address (if different than mailing address)
Lake Cunningham
2305 S. White Rd.
San Jose, CA 95148

6. Transporter 1 Company Name: ENV Environmental International, Inc.
U.S. EPA ID Number: CAR000247189

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
Potrero Hills Landfill
3675 Potrero Hills Lane
Suisun, CA 94585
Facility's Phone: (707) 432-4622
U.S. EPA ID Number: CAR000089466

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non-Hazardous Waste Solid (soil)	16	DM	8000	P
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

9 b1: Profile Number:__________________

Always wear proper PPE when handling this material

Send invoice to: ENV America // Project No. APEX1405

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: David Solis / Agent for Generator
Signature:
Month 12 Day 10 Year 14

GENERATOR

15. International Shipments ☐ Import to U.S. ☐ Export from U.S.
Port of entry/exit:
Transporter Signature (for exports only):
Date leaving U.S.:

INT'L

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name:
Signature:
Month Day Year

Transporter 2 Printed/Typed Name:
Signature:
Month Day Year

TRANSPORTER

17. Discrepancy
17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

17b. Alternate Facility (or Generator)
U.S. EPA ID Number:
Facility's Phone:

17c. Signature of Alternate Facility (or Generator)
Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a
Printed/Typed Name:
Signature:
Month 12 Day 14 Year

DESIGNATED FACILITY

POTRERO HILLS LANDFILL, INC.
Weighed at:
POTRERO HILLS LANDFILL, INC.
P.O. Box 68
FAIRFIELD, CA 94533

Deputy: Jaclyn Deleon
DriverOn?: N

Origin: SAN JOSE
DATE IN: 12/12/2014 TIME IN: 08:32:12
DATE OUT: 12/12/2014 TIME OUT: 08:56:56
Job: PHLF14692
INBOUND TICKET Number: 01-524986

MANUAL GROSS WT.	16880	LB
SCALE 3 TARE WT.	9600	LB
NET WEIGHT	7280	LB

Qty	Description
16.00	Drum Disposal

WEIGHMASTER CERTIFICATE:

THIS IS TO CERTIFY that the following described commodity was weighed, measured, or counted by a weighmaster, whose signature is on this certificate,
who is a recognized authority of accuracy, as prescribed by Chapter 7 (commencing with Section 12700) of Division 5 of the California Business and Professions Code), administered by the Division of Measurement Standards of the California Department of Food and Agriculture.

X_____________________________________
(Deputy Signature)

This is to certify that this load does not contain any hazardous materials, medical waste or liquids of any type.

X_____________________________________
(Driver Signature)

APPENDIX B

LABORATORY TEST DATA

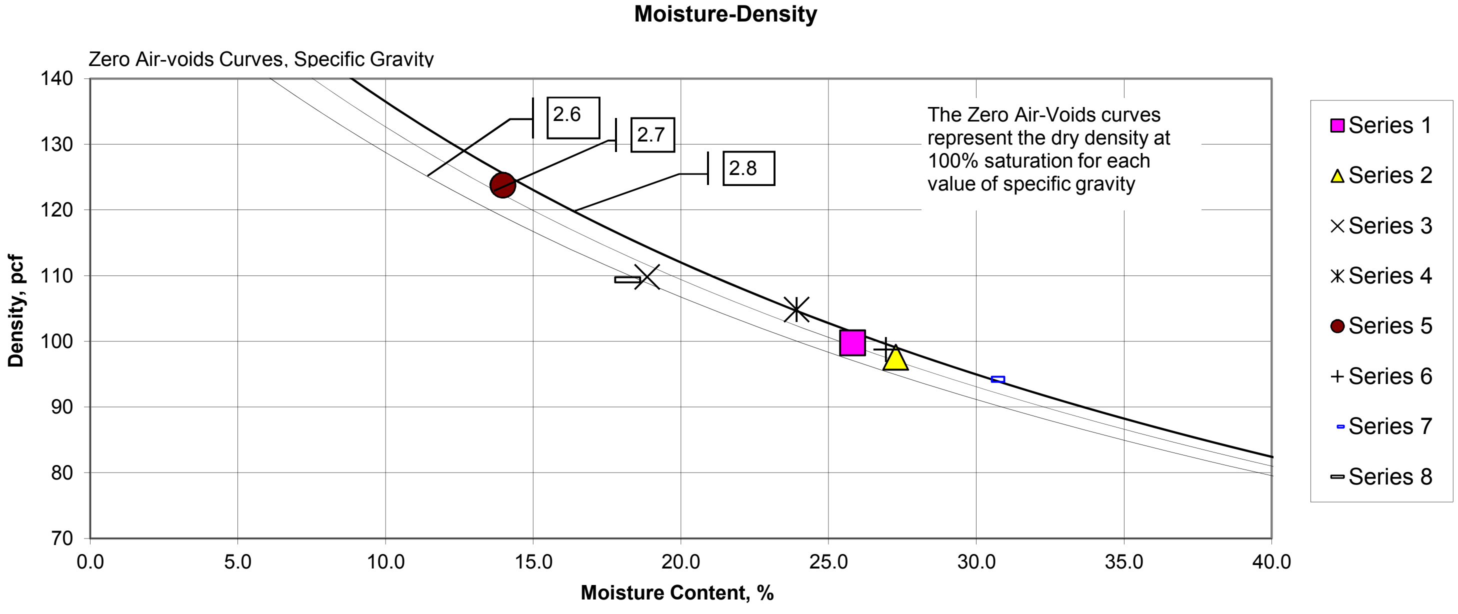
Moisture-Density-Porosity Report

Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No: 336-275a **Project No.** 20150025.002A **By:** RU
Client: Kleinfelder **Date:** 12/12/14
Project Name: SCVWD Lake Cunningham Berms **Remarks:**

Boring:	B-1	B-1	B-2	B-2	B-2	B-2	B-3	B-4
Sample:	9A	7A	4A	8A	9A	11A	10A	4A
Depth, ft:	31-31.5	19.5-20	9.5-10	24.5-25	31-31.5	41-41.5	29.5-30	9.5-10
Visual Description:	Olive Gray CLAY w/ Sand	Olive Gray CLAY w/ Sand	Very Dark Gray Sandy CLAY	Very Dark Gray CLAY w/ Sand	Olive Sandy CLAY	Very Dark Gray CLAY w/ Sand	Olive CLAY w/ Sand	Dark Gray Sandy CLAY
Actual G_s								
Assumed G_s	2.80	2.80	2.70	2.80	2.80	2.80	2.80	2.70
Moisture, %	25.8	27.3	18.9	23.9	14.0	26.9	30.5	18.2
Wet Unit wt, pcf	125.5	124.2	130.5	129.8	141.1	125.3	122.9	129.2
Dry Unit wt, pcf	99.7	97.6	109.8	104.8	123.8	98.7	94.2	109.3
Dry Bulk Dens.pb, (g/cc)	1.60	1.56	1.76	1.68	1.98	1.58	1.51	1.75
Saturation, %	95.9	96.3	94.8	100.0	94.6	97.7	99.7	90.5
Total Porosity, %	43.0	44.2	34.9	40.1	29.3	43.6	46.2	35.2
Volumetric Water Cont,Θw,%	41.2	42.6	33.1	40.1	27.7	42.6	46.0	31.8
Volumetric Air Cont., Θa,%	1.8	1.6	1.8	0.0	1.6	1.0	0.1	3.3
Void Ratio	0.75	0.79	0.54	0.67	0.41	0.77	0.86	0.54
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



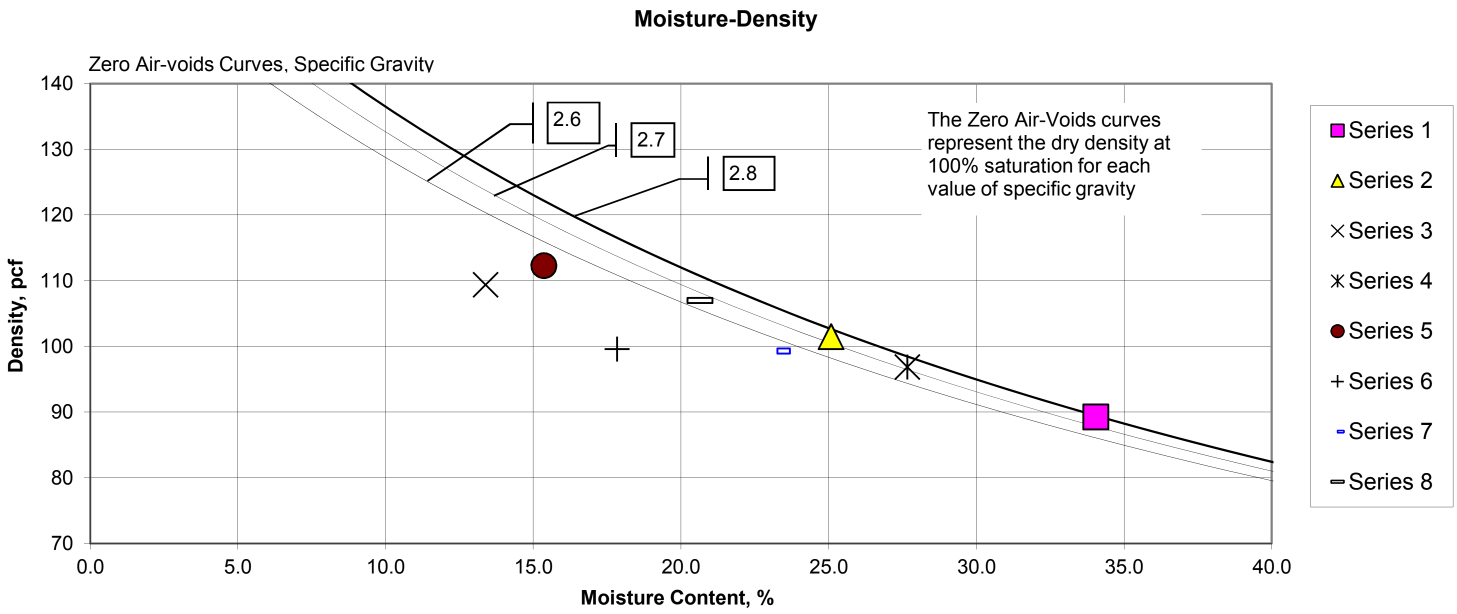
The Zero Air-Voids curves represent the dry density at 100% saturation for each value of specific gravity

Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

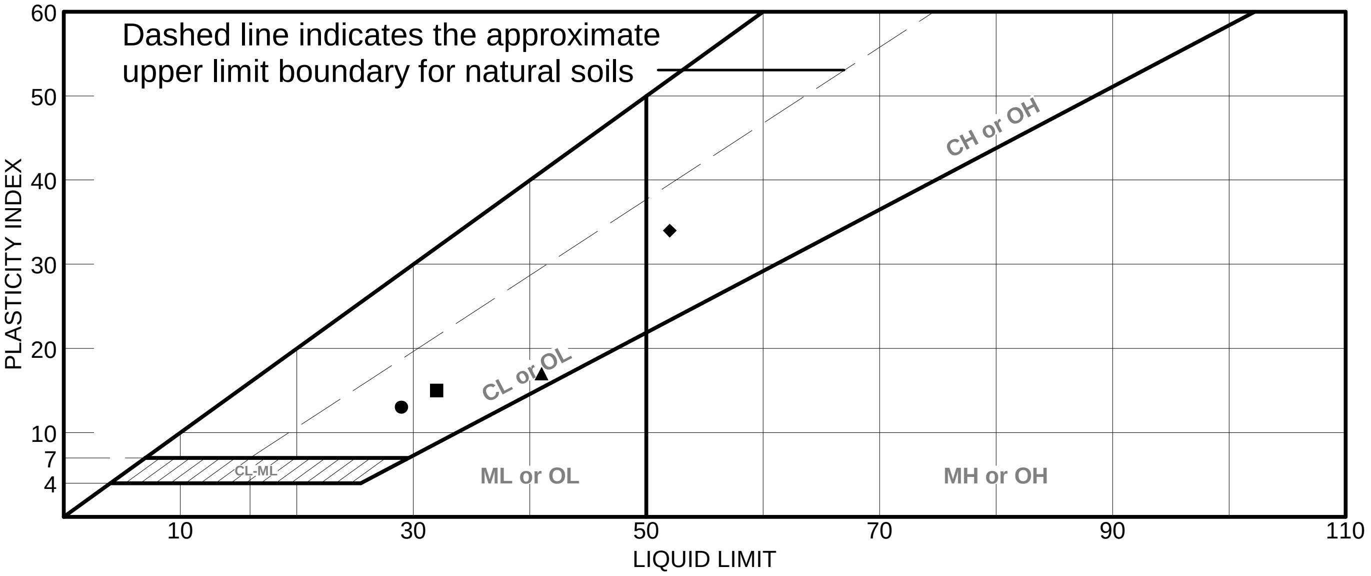
CTL Job No: 336-275b
Project No. 20150025.002A
By: RU
Client: Kleinfelder
Date: 12/12/14
Project Name: SCVWD Lake Cunningham Berms
Remarks:

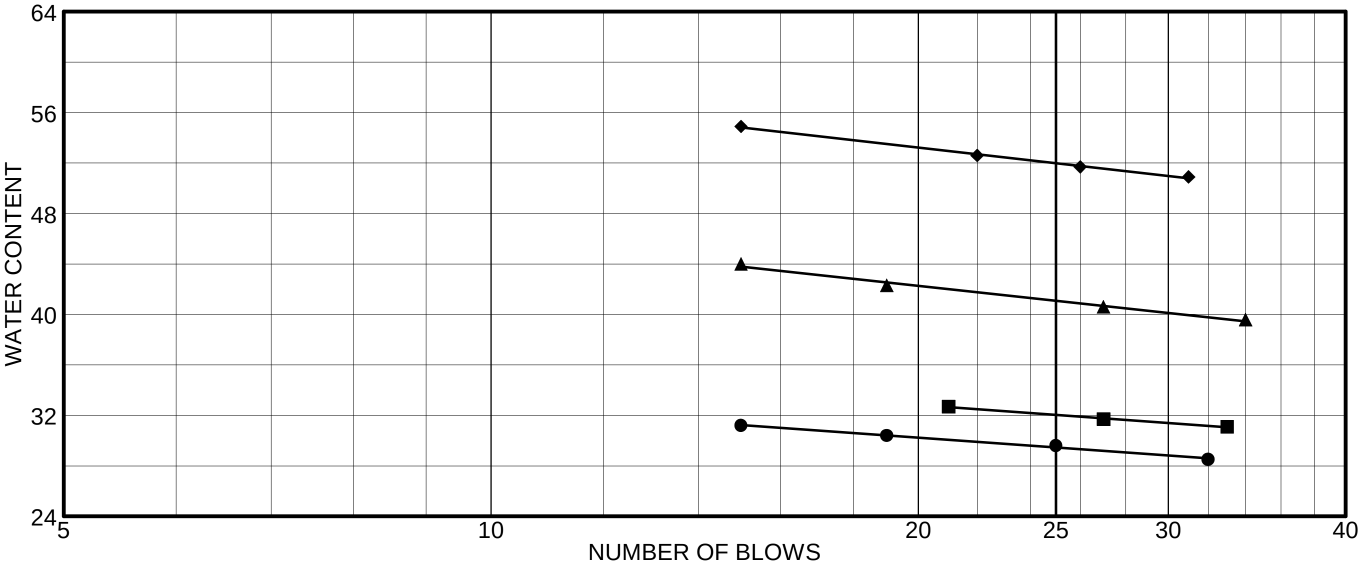
Boring:	B-4	B-4	B-5	B-5	B-6	B-6	B-6	B-6
Sample:	10A	11A	3A	9A	1A	4A	6A	9A
Depth, ft:	31-31.5	36-36.5	7-7.5	31-31.5	3-3.5	12-12.5	19.5-20	26-26.5
Visual Description:	Dark Gray CLAY w/ Sand	Very Dark Gray Sandy CLAY	Olive Clayey SAND	Pale Yellow CLAY w/ Sand	Dark Olive Gray Sandy CLAY	Gray Sandy CLAY	Olive Sandy CLAY	Olive Sandy CLAY
Actual G_s								
Assumed G_s	2.80	2.80	2.70	2.80	2.70	2.70	2.70	2.70
Moisture, %	34.0	25.1	13.4	27.7	15.4	17.8	23.3	20.6
Wet Unit wt, pcf	119.6	126.9	124.0	123.6	129.5	117.3	122.4	129.0
Dry Unit wt, pcf	89.2	101.4	109.3	96.8	112.3	99.5	99.3	106.9
Dry Bulk Dens.pb, (g/cc)	1.43	1.62	1.75	1.55	1.80	1.59	1.59	1.71
Saturation, %	99.2	96.9	66.6	96.0	82.6	69.3	89.8	96.5
Total Porosity, %	49.0	42.0	35.2	44.7	33.4	41.0	41.1	36.6
Volumetric Water Cont,Θw,%	48.6	40.7	23.4	42.9	27.6	28.4	37.0	35.3
Volumetric Air Cont., Θa,%	0.4	1.3	11.7	1.8	5.8	12.6	4.2	1.3
Void Ratio	0.96	0.72	0.54	0.81	0.50	0.69	0.70	0.58
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive Lean CLAY	29	16	13			
■	Grayish Brown Lean CLAY	32	17	15			
▲	Olive Brown Lean CLAY	41	24	17			
◆	Dark Olive Gray Fat CLAY w/ Sand	52	18	34			

Project No. 336-275 **Client:** Kleinfelder

Project: SCVWD Lake Cunningham Berms - 20150225.002A

● **Source:** B-2 **Sample No.:** S-6B **Elev./Depth:** 14'
■ **Source:** B-2 **Sample No.:** 6A **Elev./Depth:** 14.5-15'
▲ **Source:** B-4 **Sample No.:** 8A **Elev./Depth:** 21-21.5'
◆ **Source:** B-6 **Elev./Depth:** 14.5-15'

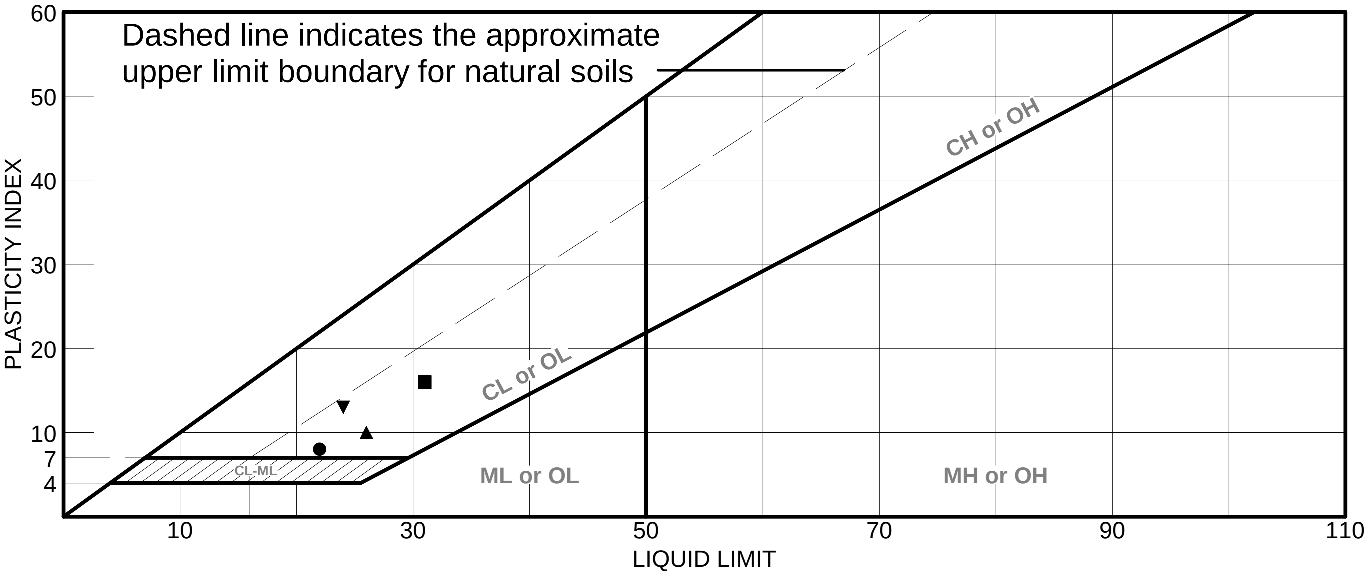
Remarks:
●
■
▲
◆

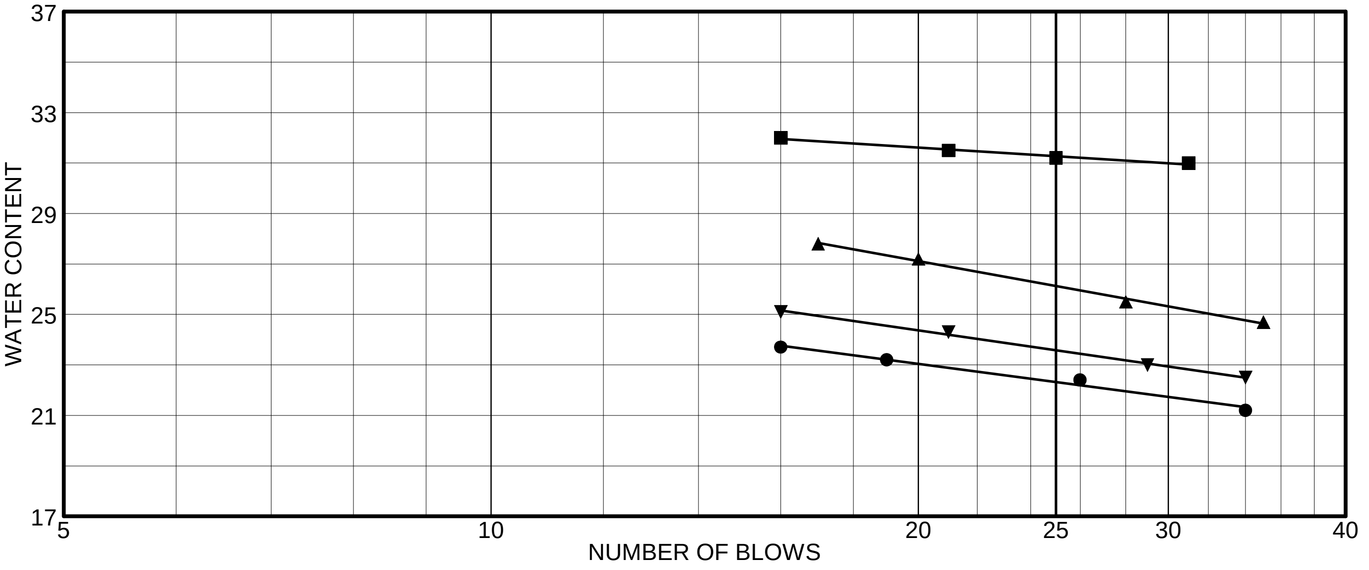
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Sandy Lean CLAY	22	14	8	94.6	62.0	CL
■	Brown Lean CLAY w/ Sand	31	15	16	96.8	77.6	CL
▲	Very Dark Brown Lean CLAY w/ Sand	26	16	10	92.2	70.7	CL
◆	Brown Silty SAND		NP	NP	88.7	39.5	SM
▼	Dark Olive Sandy Lean CLAY	24	11	13			

Project No. 336-275 **Client:** Kleinfelder

Project: SCVWD Lake Cunningham Berms - 20150225.002A

● **Source:** TP-1 **Sample No.:** 2 **Elev./Depth:** 2.5-4'
■ **Source:** TP-2 **Sample No.:** 2 **Elev./Depth:** 1.3-4.5'
▲ **Source:** TP-3 **Sample No.:** 2 **Elev./Depth:** 2.5-4'
◆ **Source:** TP-4 **Sample No.:** 4 **Elev./Depth:** 3-4'
▼ **Source:** B-1 **Sample No.:** S-6A **Elev./Depth:** 14.5-15'

Remarks:
●
■
▲
◆ Could not roll out. Sample slides in bowl. Non-plastic.
▼

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

COOPER
TESTING LABORATORY

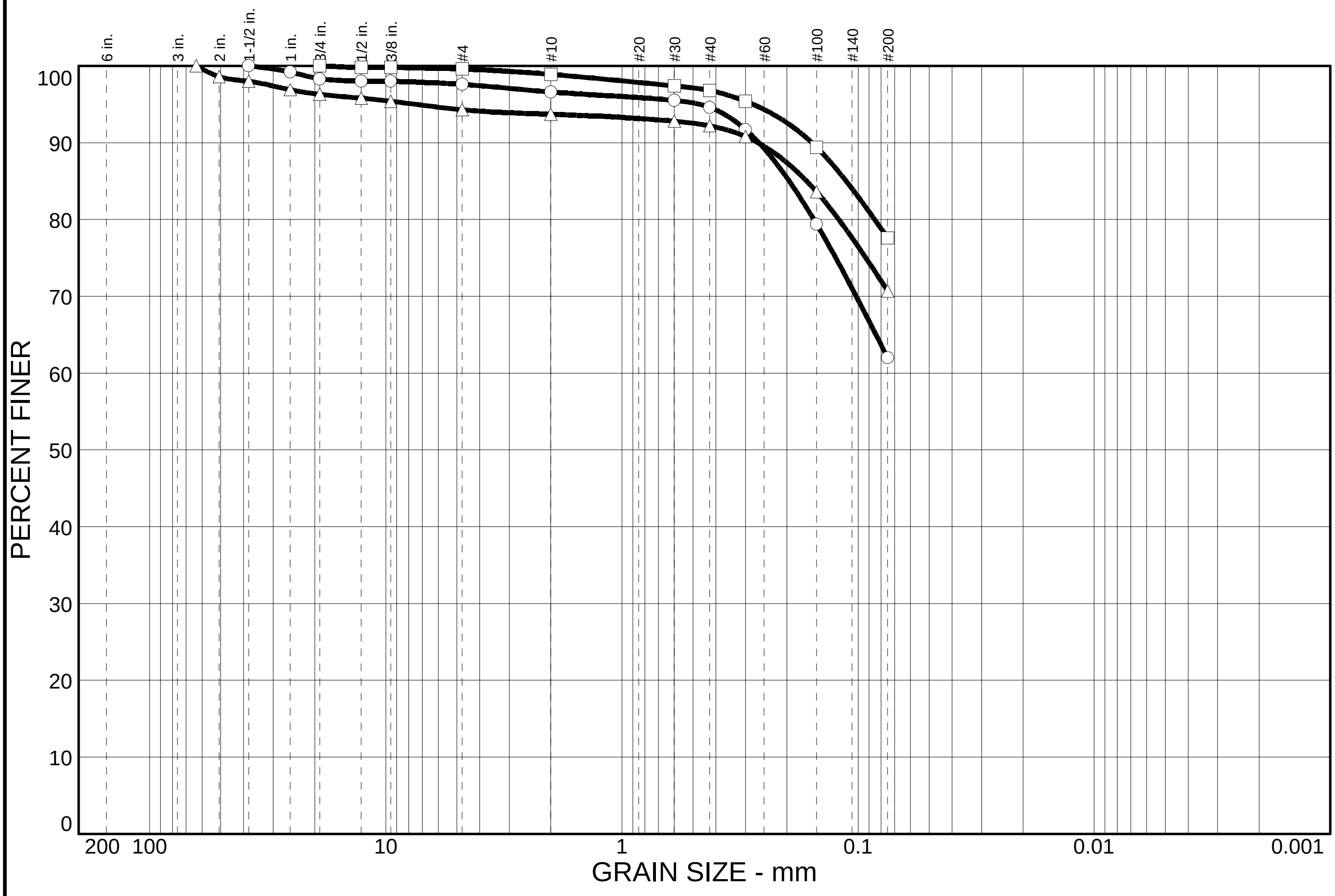
#200 Sieve Wash Analysis
ASTM D 1140

Job No.: 336-275
Client: Kleinfelder
Project: SCVWD Lake Cunningham Berms
Project No.: 20150225.002A
Date: 12/19/2014
Run By: MD
Checked By: DC

Boring:	B-1	B-1	B-1	B-3	B-4	B-5	B-6	
Sample:	2A	4A	S-6A	S-5A	3A	S-1A	5A	
Depth, ft.:	4.5-5	9.5-10	14.5-15	12-12.5	4-4.5	3	14.5-15	
Soil Type:	Dark Olive Brown CLAY	Dark Olive Brown Silty SAND	Dark Olive Sandy Lean CLAY	Very Dark Olive Gray CLAY w/ Sand	Very Dark Olive Gray CLAY w/ Sand	Dark Olive Brown CLAY w/ Sand	Dark Olive Gray Fat CLAY w/ Sand	
Wt of Dish & Dry Soil, gm	598.2	518.7	321.6	703.0	366.4	631.2	586.7	
Weight of Dish, gm	311.2	77.6	81.8	261.1	194.0	280.3	337.6	
Weight of Dry Soil, gm	287.0	441.1	239.8	441.9	172.5	350.9	249.1	
Wt. Ret. on #4 Sieve, gm	0.0	9.0	0.0	11.9	1.9	1.4	0.7	
Wt. Ret. on #200 Sieve, gm	21.2	322.7	96.1	126.8	37.7	67.7	63.6	
% Gravel	**0.0**	**2.0**	**0.0**	**2.7**	**1.1**	**0.4**	**0.3**	
% Sand	**7.4**	**71.1**	**40.1**	**26.0**	**20.8**	**18.9**	**25.3**	
% Silt & Clay	**92.6**	**26.8**	**59.9**	**71.3**	**78.1**	**80.7**	**74.5**	

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		2.4	35.6	62.0		CL		14	22
□		0.4	22.0	77.6		CL		15	31
△		5.7	23.6	70.7		CL		16	26

SIEVE inches size	PERCENT FINER ○	□	△
2.5			100.0
2			98.6
1.5"	100.0		98.0
1"	99.2		96.9
3/4"	98.3	100.0	96.3
1/2"	98.0	99.8	95.8
3/8"	98.0	99.8	95.4
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	97.6	99.6	94.3
#10	96.6	98.9	93.7
#30	95.5	97.4	92.8
#40	94.6	96.8	92.2
#50	91.7	95.4	90.8
#100	79.4	89.4	83.6
#200	62.0	77.6	70.7

SOIL DESCRIPTION

○ Brown Sandy Lean CLAY

□ Brown Lean CLAY w/ Sand

△ Very Dark Brown Lean CLAY w/ Sand

REMARKS:

○

□

△

○ Source: TP-1	Sample No.: 2	Elev./Depth: 2.5-4'
□ Source: TP-2	Sample No.: 2	Elev./Depth: 1.3-4.5'
△ Source: TP-3	Sample No.: 2	Elev./Depth: 2.5-4'

COOPER TESTING LABORATORY

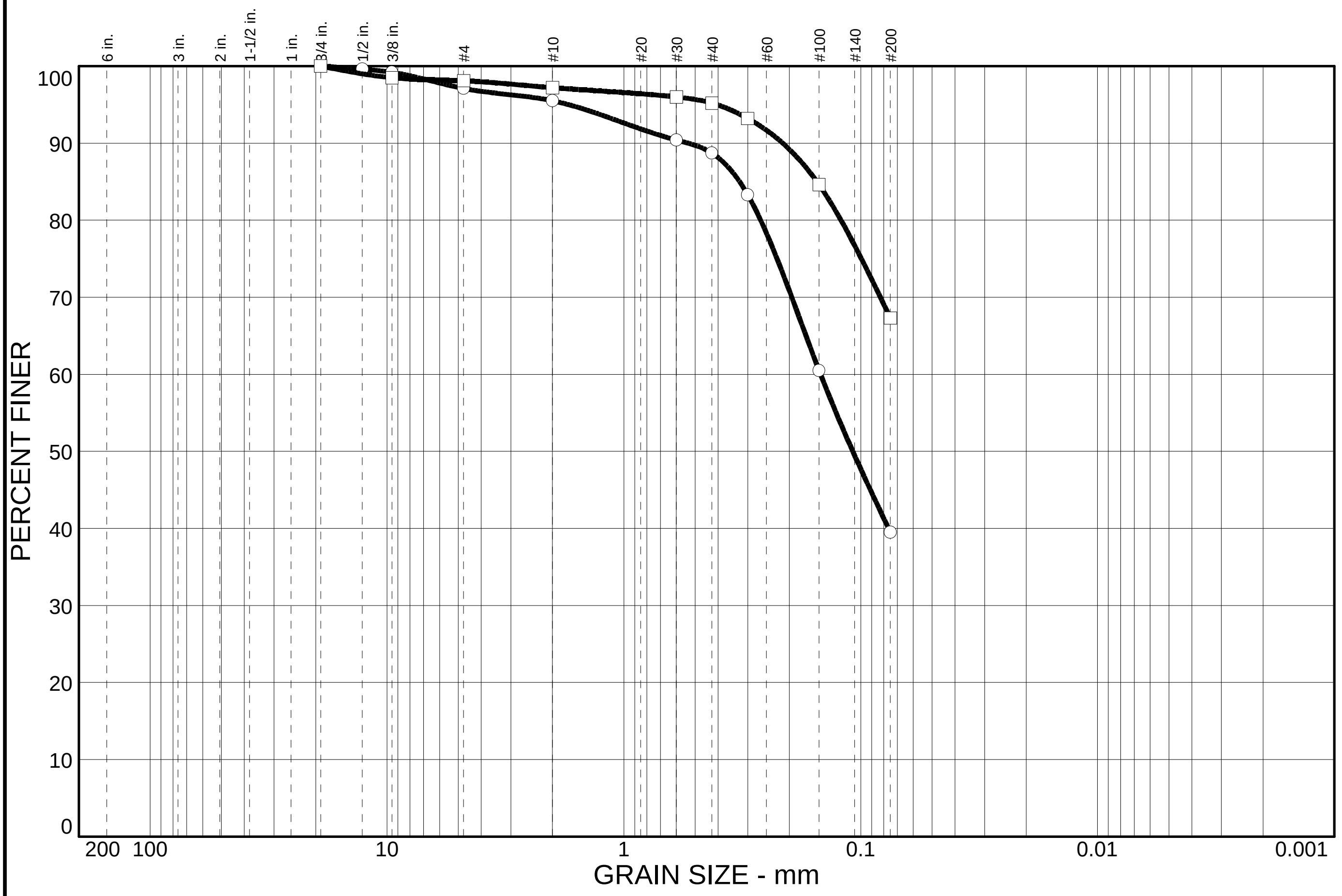
Client: Kleinfelder

Project: SCVWD Lake Cunningham Berms - 20150225.002A

Project No.: 336-275

Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		2.9	57.6	39.5		SM		NP	
□		1.9	30.8	67.3					

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER
3/4"	100.0	100.0	
1/2"	99.6		
3/8"	99.2	98.5	
	GRAIN SIZE		
D_{60}	0.148		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER
#4	97.1	98.1	
#10	95.5	97.2	
#30	90.4	96.0	
#40	88.7	95.2	
#50	83.3	93.2	
#100	60.5	84.6	
#200	39.5	67.3	

SOIL DESCRIPTION

○ Brown Silty SAND

□ Dark Olive Brown Sandy CLAY

REMARKS:

○

□

○ Source: TP-4 Sample No.: 4 Elev./Depth: 3-4'

□ Source: B-3 Sample No.: S-2A Elev./Depth: 4.5-5'

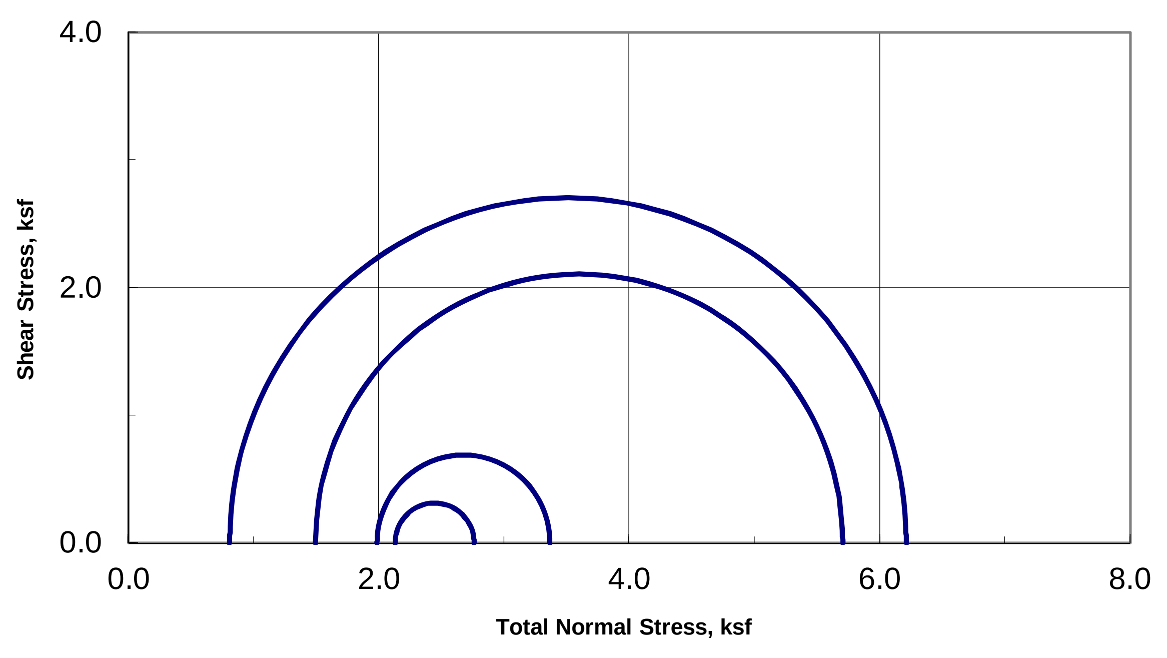
COOPER TESTING LABORATORY

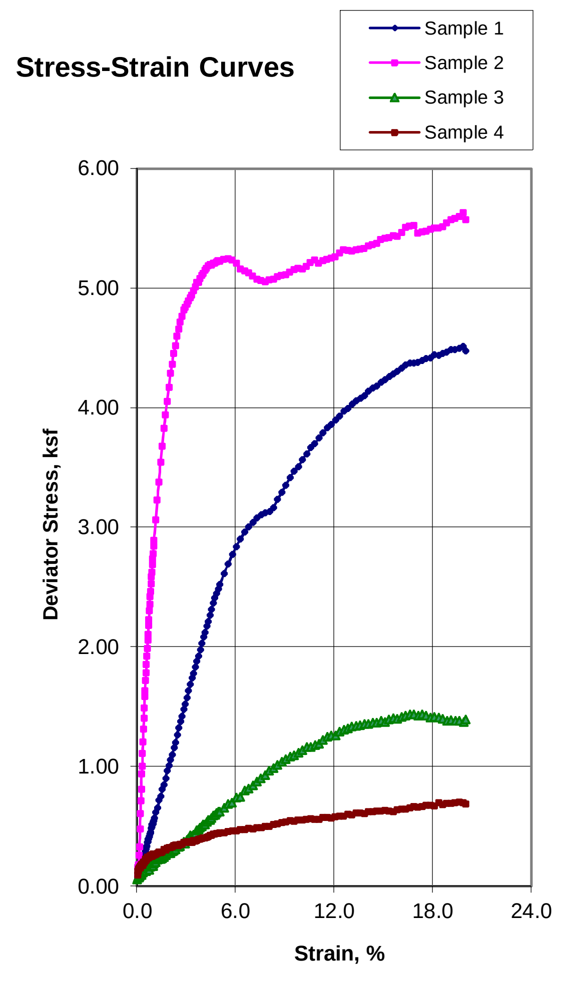
Client: Kleinfelder

Project: SCVWD Lake Cunningham Berms - 20150225.002A

Project No.: 336-275 Figure

Unconsolidated-Undrained Triaxial Test
ASTM D2850





Sample Data	1	2	3	4
Moisture %	20.0	14.9	23.9	26.7
Dry Den,pcf	110.2	110.4	103.0	98.4
Void Ratio	0.558	0.554	0.667	0.745
Saturation %	98.5	74.0	98.4	98.7
Height in	5.01	5.01	4.99	4.71
Diameter in	2.41	2.39	2.41	2.41
Cell psi	10.4	5.6	13.8	14.8
Strain %	15.00	15.00	15.00	15.00
Deviator, ksf	4.214	5.409	1.381	0.631
Rate %/min	1.00	1.00	1.00	1.00
in/min	0.050	0.050	0.050	0.047
Job No.:	**336-275a**			
Client:	**Kleinfelder**			
Project:	**SCVWD Lake Cunningham Berms - 20150225.002A**			
Boring:	B-1	B-2	B-3	B-4
Sample:	6A	3A	9A	9A
Depth ft:	14.5-15	7-7.5	24.5-25	26-26.5

Visual Soil Description

Sample #	
1	Dark Olive Brown Silty SAND (slightly plastic)
2	Dark Olive Brown Clayey SAND (Silty)
3	Olive Silty SAND (slightly plastic)
4	Olive Clayey SAND

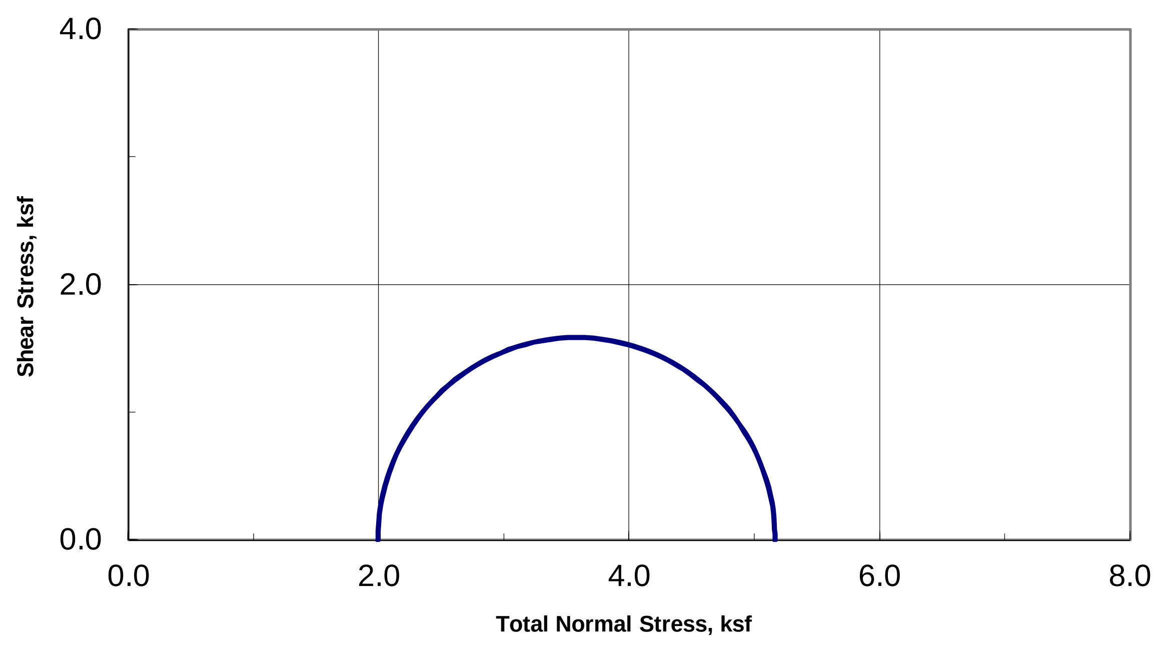
Remarks:

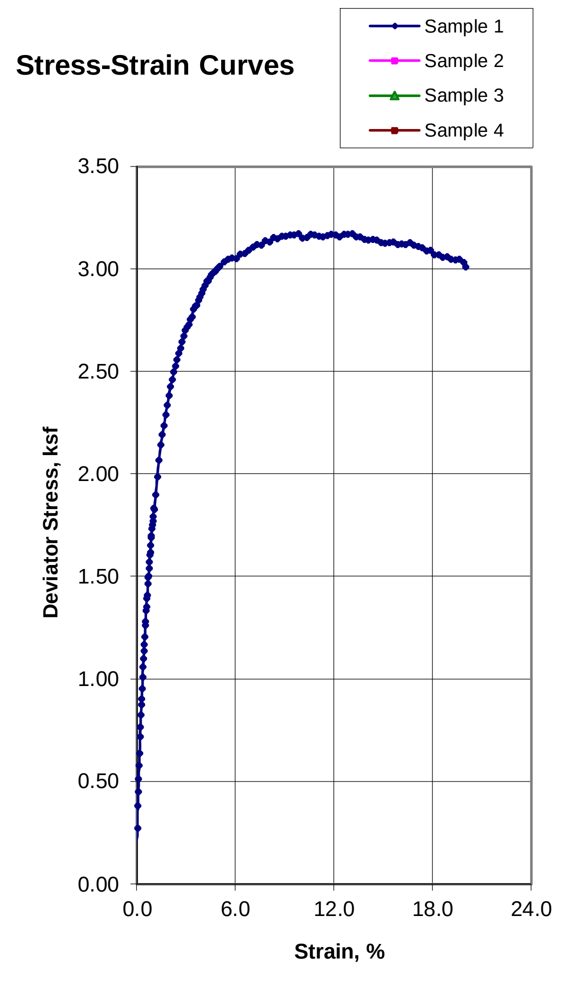
Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

Cooper Testing Labs, Inc.
937 Commercial Street
Palo Alto, CA 94303

Unconsolidated-Undrained Triaxial Test

ASTM D2850





Sample Data

	1	2	3	4
Moisture %	31.9			
Dry Den,pcf	90.1			
Void Ratio	0.872			
Saturation %	98.7			
Height in	5.00			
Diameter in	2.41			
Cell psi	13.8			
Strain %	13.09			
Deviator, ksf	3.174			
Rate %/min	1.00			
in/min	0.050			

Job No.:	**336-275b**			
Client:	**Kleinfelder**			
Project:	**SCVWD Lake Cunningham Berms - 20150225.002A**			
Boring:	B-5			
Sample:	7A			
Depth ft:	19.5-20			

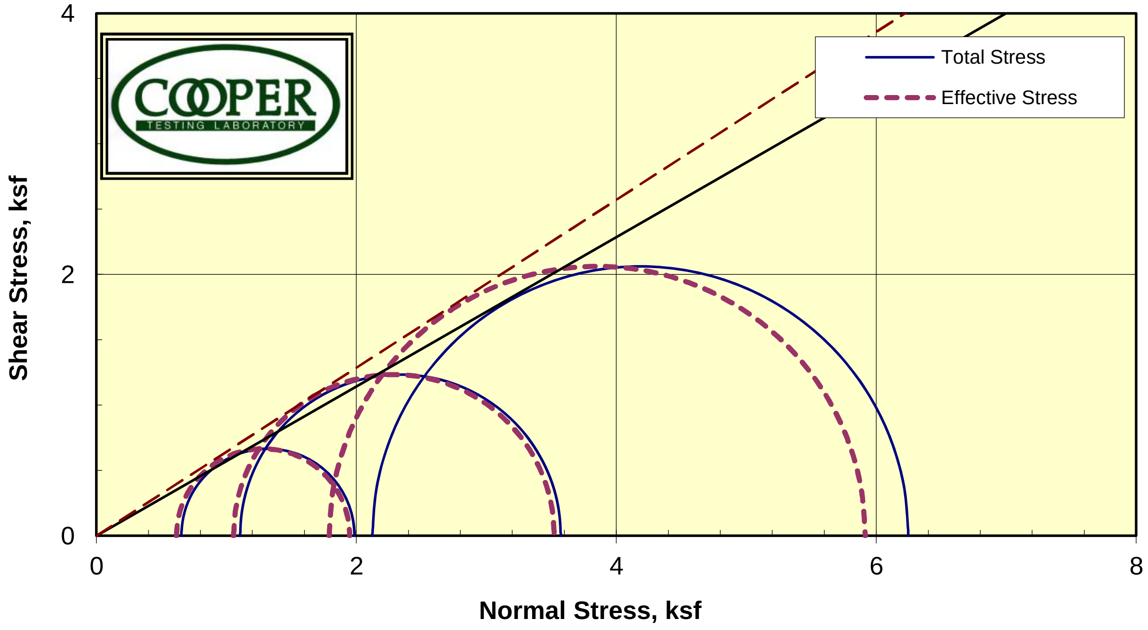
Visual Soil Description

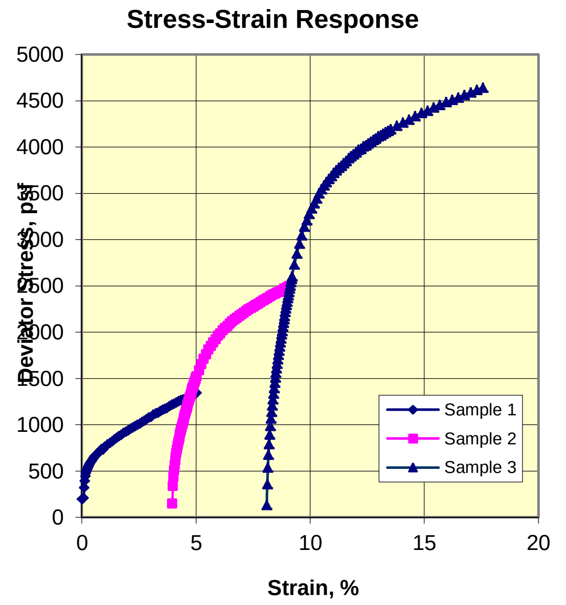
Sample #	
1	Very Dark Gray CLAY
2	
3	
4	

Remarks:

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

Triaxial Consolidated Undrained with Pore Pressure
(ASTM D4767m)





Stage	1	2	3
MC, %	25.0		
Dry Dens., pcf.	99.2		
Sat. %	96.5		
Void Ratio	0.699		
Diameter in	2.40		
Height, in	5.00		
		Final	
MC, %	25.2	24.4	23.4
Dry Dens., pcf.	99.2	100.4	102.1
Sat. %	100.0	100.0	100.0
Void Ratio	0.681	0.660	0.632
Diameter, in	2.41	2.43	2.46
Height, in	4.98	4.81	4.63
Cell, psi	53.5	56.8	64.7
BP, psi	49.0	49.1	50.0
		Effective Stresses At:	
Strain, %	5.0	5.0	5.0
Deviator ksf	1.333	2.469	4.125
Excess PP	0.037	0.050	0.332
Sigma 1	1.949	3.524	5.916
Sigma 3	0.616	1.055	1.791
P, ksf	1.283	2.289	3.853
Q, ksf	0.666	1.234	2.063
Stress Ratio	3.163	3.339	3.303
Rate in/min	0.0005	0.0005	0.0005

Total C	0	Effective C	0.0
Total Phi	29.7	Effective Phi	32.7

©

Job No.: 336-275 **Date:** 12/16/2014

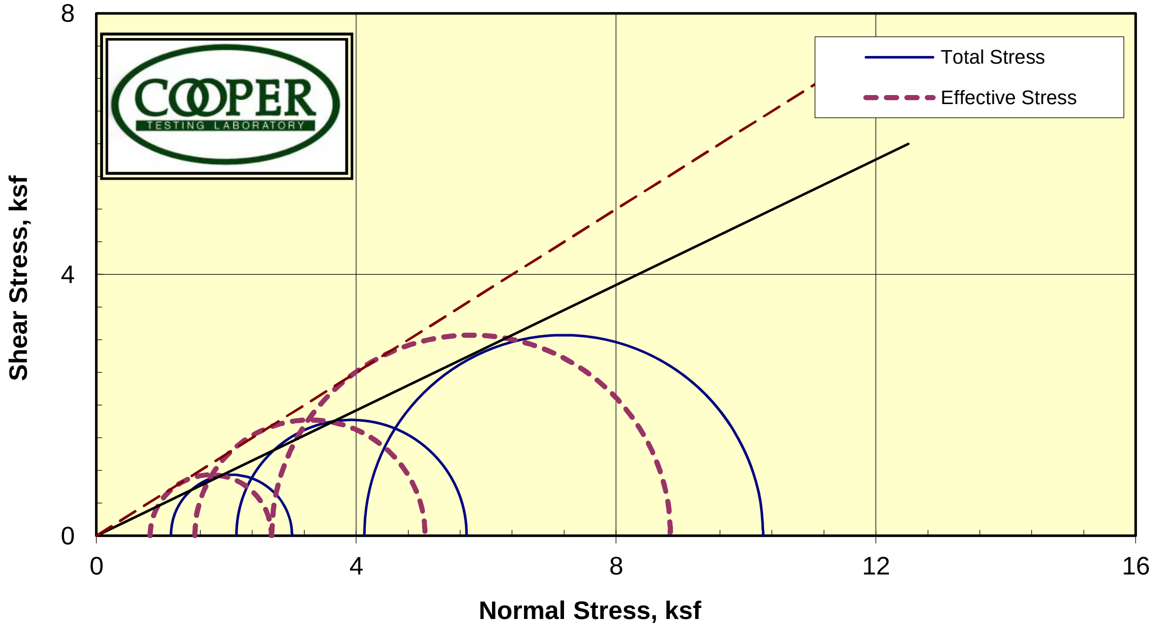
Client: Kleinfelder BY:DC

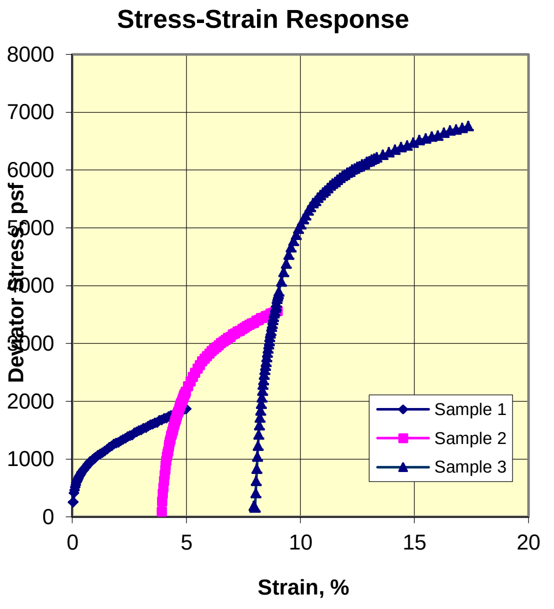
Project: 20150225.002A

Sample: B-2,-5-6A @14.5'-15' Grayish Brown CLAY

Remarks: ** Staged Test ** Strengths at 5% strain.

Triaxial Consolidated Undrained with Pore Pressure
(ASTM D4767m)





Job No.: 336-275 **Date:** 12/16/2014
Client: Kleinfelder BY:DC
Project: 20150225.002A
Sample: B-4;8A @ 21-21.5' Olive Brown CLAY
Remarks: ** Staged Test ** Strengths at 5% strain.

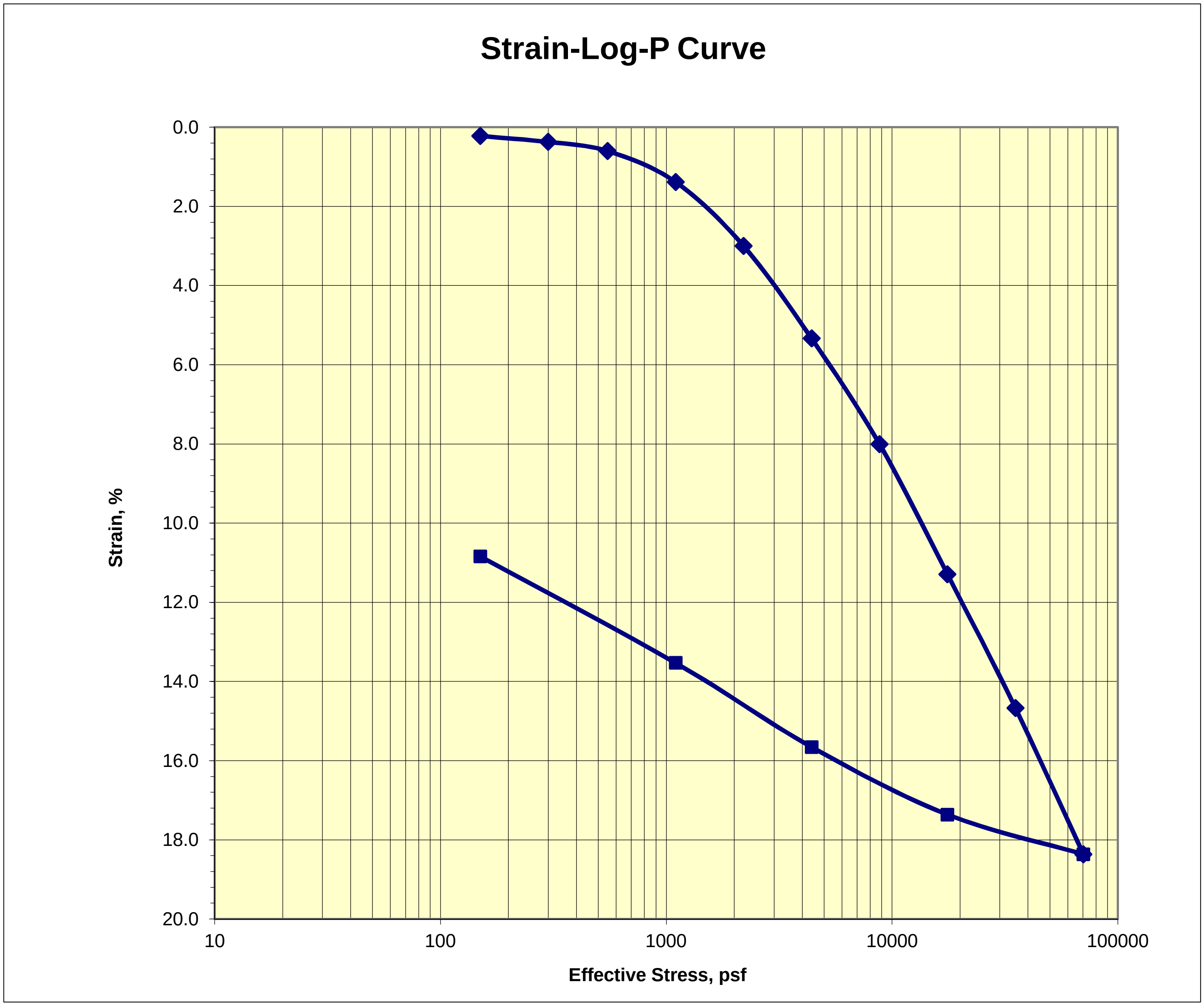
Stage	1	2	3
MC, %	30.3		
Dry Dens., pcf.	93.8		
Sat. %	98.3		
Void Ratio	0.863		
Diameter in	2.41		
Height, in	5.00		
		Final	
MC, %	29.2	27.9	26.5
Dry Dens., pcf.	94.8	96.6	98.8
Sat. %	100.0	100.0	100.0
Void Ratio	0.818	0.783	0.742
Diameter, in	2.41	2.42	2.44
Height, in	4.97	4.81	4.63
Cell, psi	56.7	64.1	78.8
BP, psi	48.7	49.2	50.1
		Effective Stresses At:	
Strain, %	5.0	5.0	5.0
Deviator ksf	1.869	3.549	6.145
Excess PP	0.318	0.640	1.425
Sigma 1	2.697	5.063	8.843
Sigma 3	0.828	1.515	2.698
P, ksf	1.762	3.289	5.770
Q, ksf	0.934	1.774	3.072
Stress Ratio	3.257	3.343	3.278
Rate in/min	0.0005	0.0005	0.0005

Total C	0	Effective C	0.0
Total Phi	25.6	Effective Phi	32.0

©

Consolidation Test
ASTM D2435

Job No.:	336-275	**Boring:**	B-1	**Run By:**	MD
Client:	Kleinfelder	**Sample:**	8A	**Reduced:**	PJ
Project:	20150225.002A	**Depth, ft.:**	24.5-25	**Checked:**	PJ/DC
Soil Type:	Olive Gray CLAY			**Date:**	12/18/2014



Assumed Gs 2.8	**Initial**	**Final**
Moisture %:	26.3	20.2
Dry Density, pcf:	99.8	111.6
Void Ratio:	0.752	0.567
% Saturation:	97.8	100.0

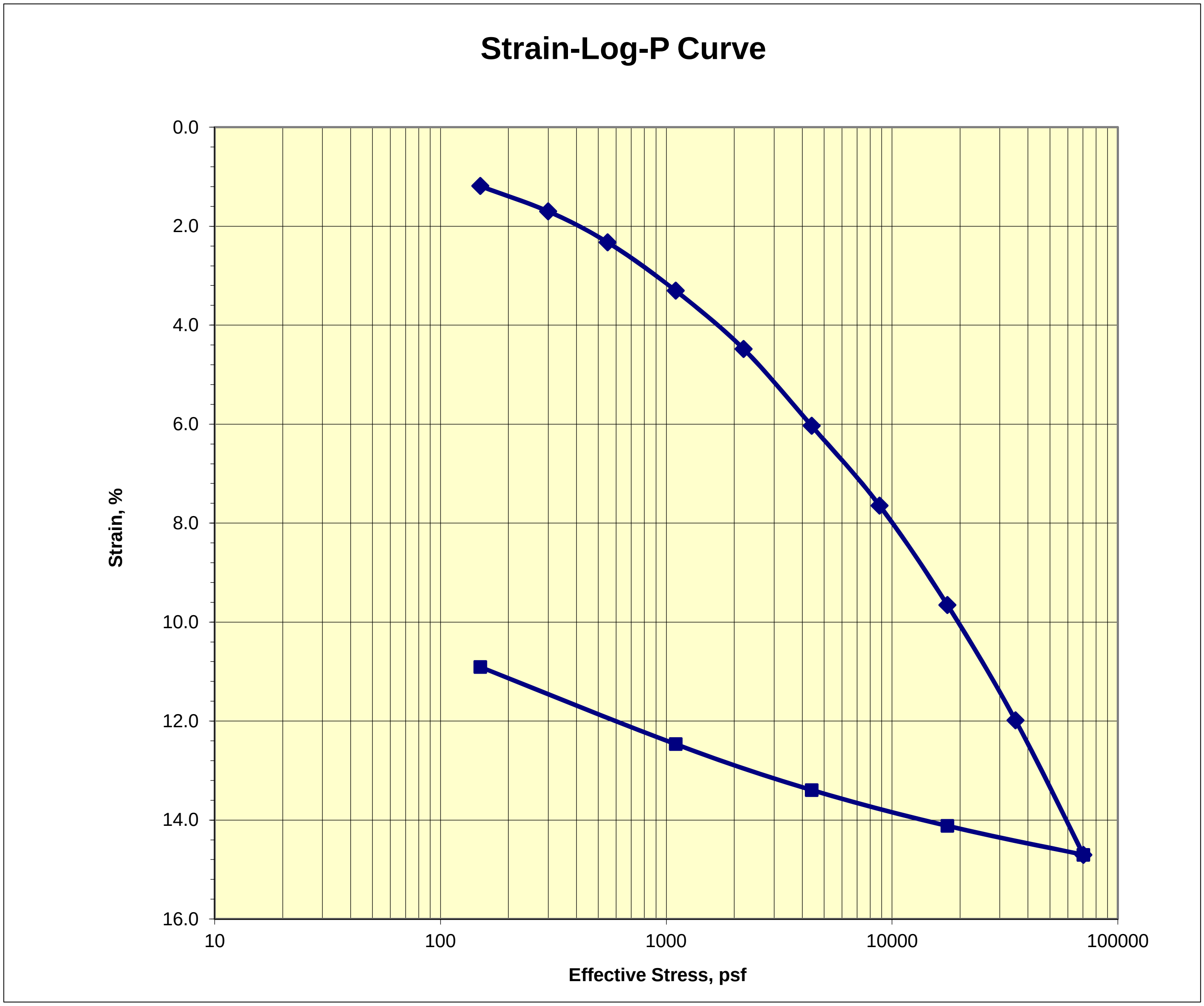
Remarks:

COOPER TESTING LABORATORY

Consolidation Test

ASTM D2435

Job No.:	336-275	**Boring:**	B-4	**Run By:**	MD
Client:	Kleinfelder	**Sample:**	9A	**Reduced:**	PJ
Project:	20150225.002A	**Depth, ft.:**	26-26.5	**Checked:**	PJ/DC
Soil Type:	Olive Clayey SAND			**Date:**	12/19/2014



Assumed Gs 2.8	Initial	Final
Moisture %:	20.9	15.8
Dry Density, pcf:	108.8	121.1
Void Ratio:	0.606	0.444
% Saturation:	96.7	100.0

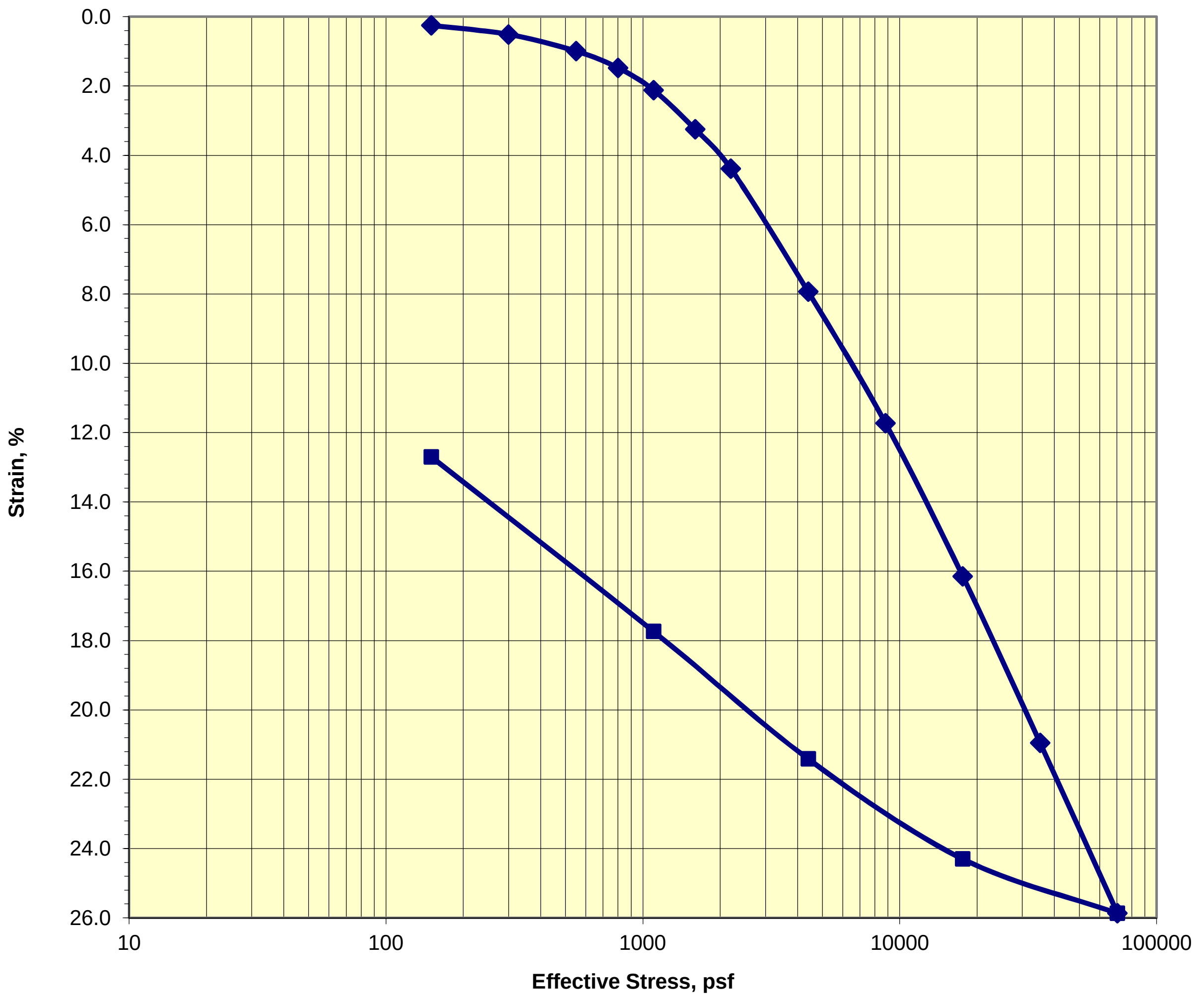
Remarks: This sample appears to have been disturbed.

Consolidation Test

ASTM D2435

Job No.:	336-275	**Boring:**	B-5	**Run By:**	MD
Client:	Kleinfelder	**Sample:**	6A	**Reduced:**	PJ
Project:	20150225.002A	**Depth, ft.:**	14.5-15	**Checked:**	PJ/DC
Soil Type:	Dark Greenish Gray CLAY			**Date:**	12/22/2014

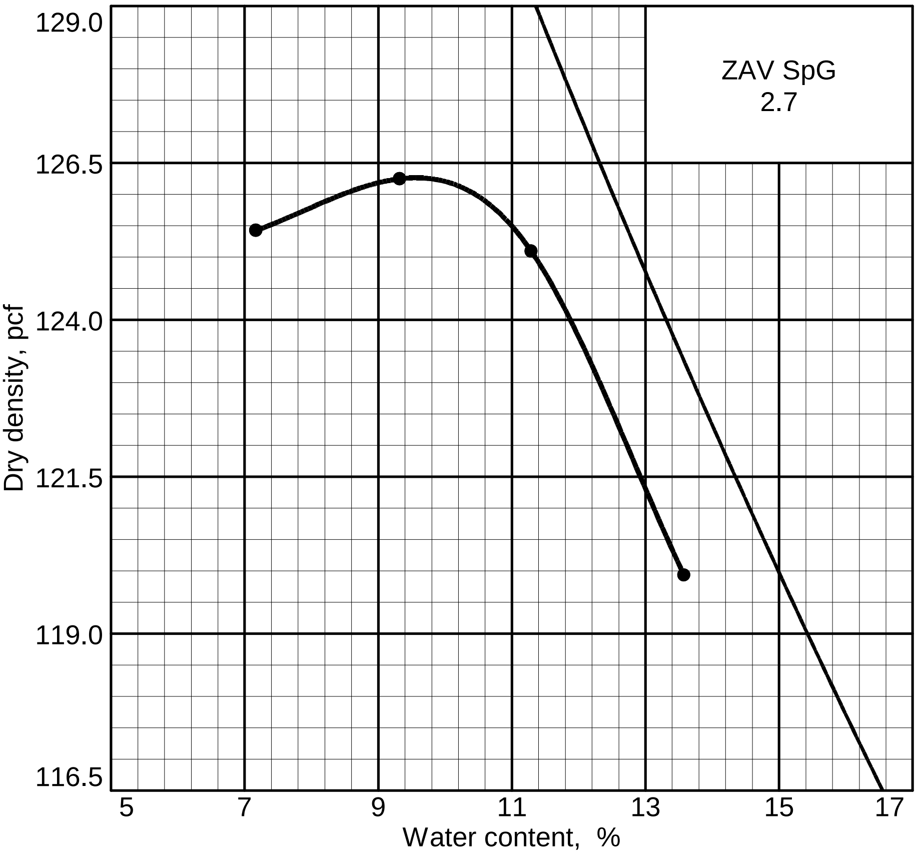
Strain-Log-P Curve



Assumed Gs 2.8	**Initial**	**Final**
Moisture %:	35.4	27.5
Dry Density, pcf:	86.1	98.8
Void Ratio:	1.029	0.770
% Saturation:	96.3	100.0

Remarks:

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-00 Method A Modified

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM ______
Sp.G. 2.7
LL 22
PI 8
%>No.4 2.4
%<#200 62.0
USCS CL
AASHTO ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.88	8.94	9.00	9.04		
WM	4.40	4.40	4.40	4.40		
WW + T #1	878.50	699.00	942.10	953.10		
WD + T #1	839.40	628.10	889.60	888.80		
TARE #1	293.90	105.80	326.30	319.20		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	7.2	13.6	9.3	11.3		
DRY DENSITY	125.4	119.9	126.2	125.1		

TEST RESULTS

Maximum dry density = 126.3 pcf

Optimum moisture = 9.6 %

Material Description

Brown Sandy Lean CLAY

Project No. 336-275 **Client:** Kleinfelder
Project: SCVWD Lake Cunningham Berms - 20150225.002A

● **Source:** TP-1 **Sample No.:** 2 **Elev./Depth:** 2.5-4'

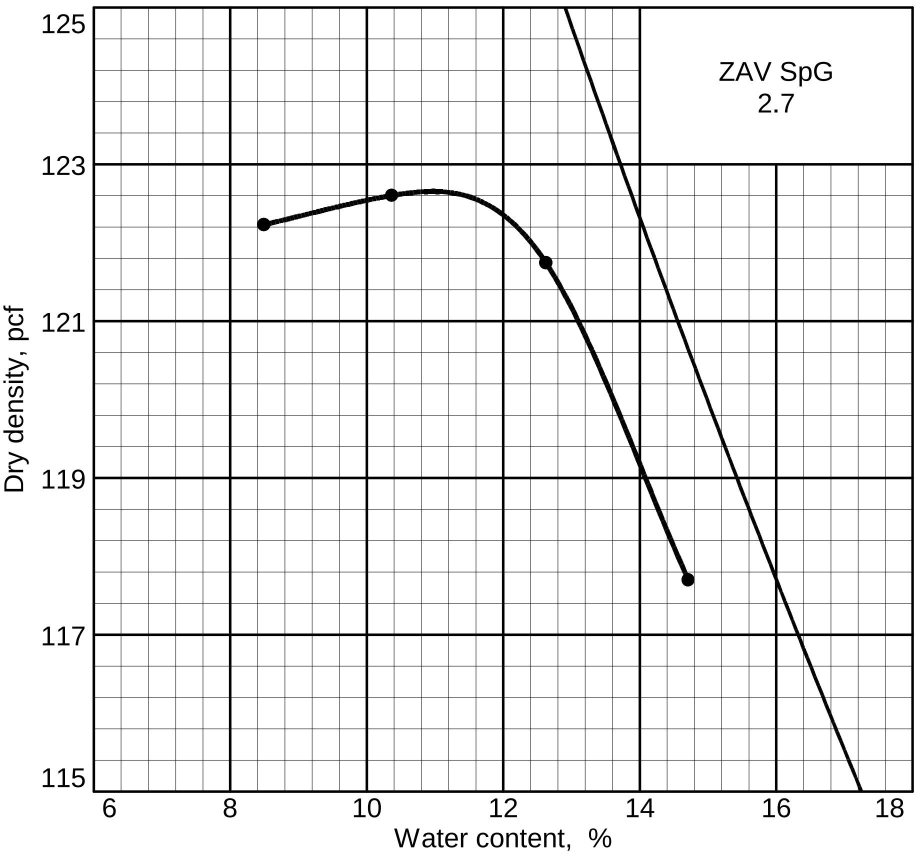
Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Figure

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-00 Method A Modified

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM		**Sp.G.**	2.7
LL	31	**PI**	16
%>No.4	0.4	**%<#200**	77.6
USCS	CL	**AASHTO**	

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.90	8.82	8.91	8.97		
WM	4.40	4.40	4.40	4.40		
WW + T #1	708.60	1012.00	758.00	886.90		
WD + T #1	630.00	958.30	695.90	820.00		
TARE #1	95.70	326.10	96.90	290.10		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	14.7	8.5	10.4	12.6		
DRY DENSITY	117.7	122.2	122.6	121.7		

TEST RESULTS

Maximum dry density = 122.7 pcf

Optimum moisture = 11.0 %

Material Description

Brown Lean CLAY w/ Sand

Project No. 336-275 **Client:** Kleinfelder
Project: SCVWD Lake Cunningham Berms - 20150225.002A

● **Source:** TP-2 **Sample No.:** 2 **Elev./Depth:** 1.3-4.5'

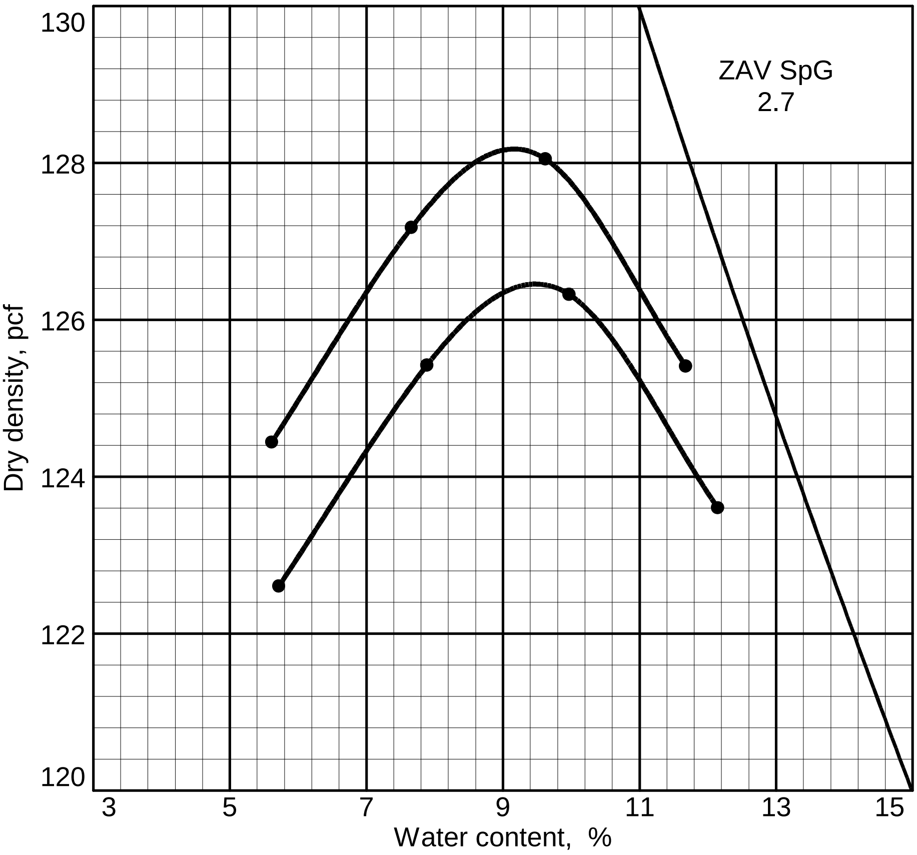
Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Figure

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-00 Method A Modified
Oversize correction applied to each point

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM ____ **Sp.G.** 2.7
LL 26 **PI** 10
%>No.4 5.7 **%<#200** 70.7
USCS CL **AASHTO** ____

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.72	8.91	9.03	9.02		
WM	4.40	4.40	4.40	4.40		
WW + T #1	947.70	988.00	1037.40	953.80		
WD + T #1	914.20	939.10	972.00	886.00		
TARE #1	328.20	319.00	315.80	327.70		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	5.6	7.7	9.6	11.7		
DRY DENSITY	124.4	127.2	128.0	125.4		

ROCK CORRECTED TEST RESULTS	UNCORRECTED	Material Description
Maximum dry density = 128.2 pcf	126.5 pcf	Very Dark Brown Lean CLAY w/ Sand
Optimum moisture = 9.2 %	9.5 %	

Project No. 336-275 **Client:** Kleinfelder
Project: SCVWD Lake Cunningham Berms - 20150225.002A

● **Source:** TP-3 **Sample No.:** 2 **Elev./Depth:** 2.5-4'

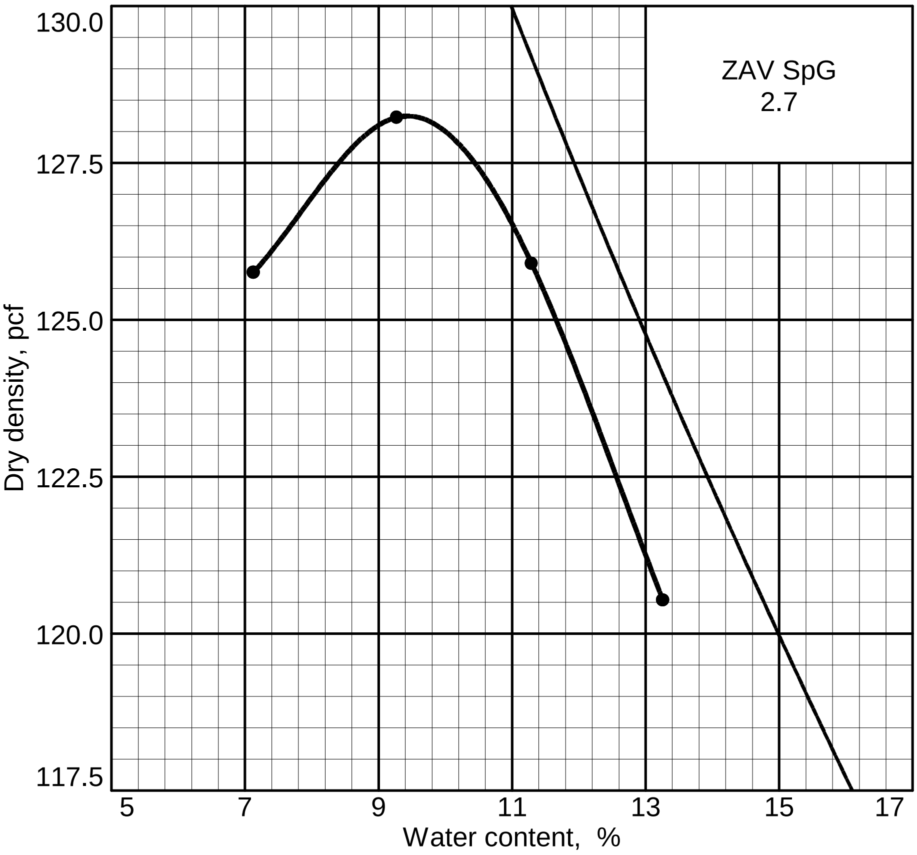
Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Figure

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-00 Method A Modified

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM		**Sp.G.**	2.7
LL		**PI**	NP
%>No.4	2.9	**%<#200**	39.5
USCS	SM	**AASHTO**	

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.89	8.95	9.07	9.07		
WM	4.40	4.40	4.40	4.40		
WW + T #1	693.50	934.90	629.30	718.60		
WD + T #1	654.00	863.30	582.20	655.80		
TARE #1	99.50	323.20	74.10	99.50		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	7.1	13.3	9.3	11.3		
DRY DENSITY	125.8	120.5	128.2	125.9		

TEST RESULTS

Maximum dry density = 128.2 pcf

Optimum moisture = 9.4 %

Material Description

Brown Silty SAND

Project No. 336-275 **Client:** Kleinfelder

Project: SCVWD Lake Cunningham Berms - 20150225.002A

● **Source:** TP-4 **Sample No.:** 4 **Elev./Depth:** 3-4'

Remarks:

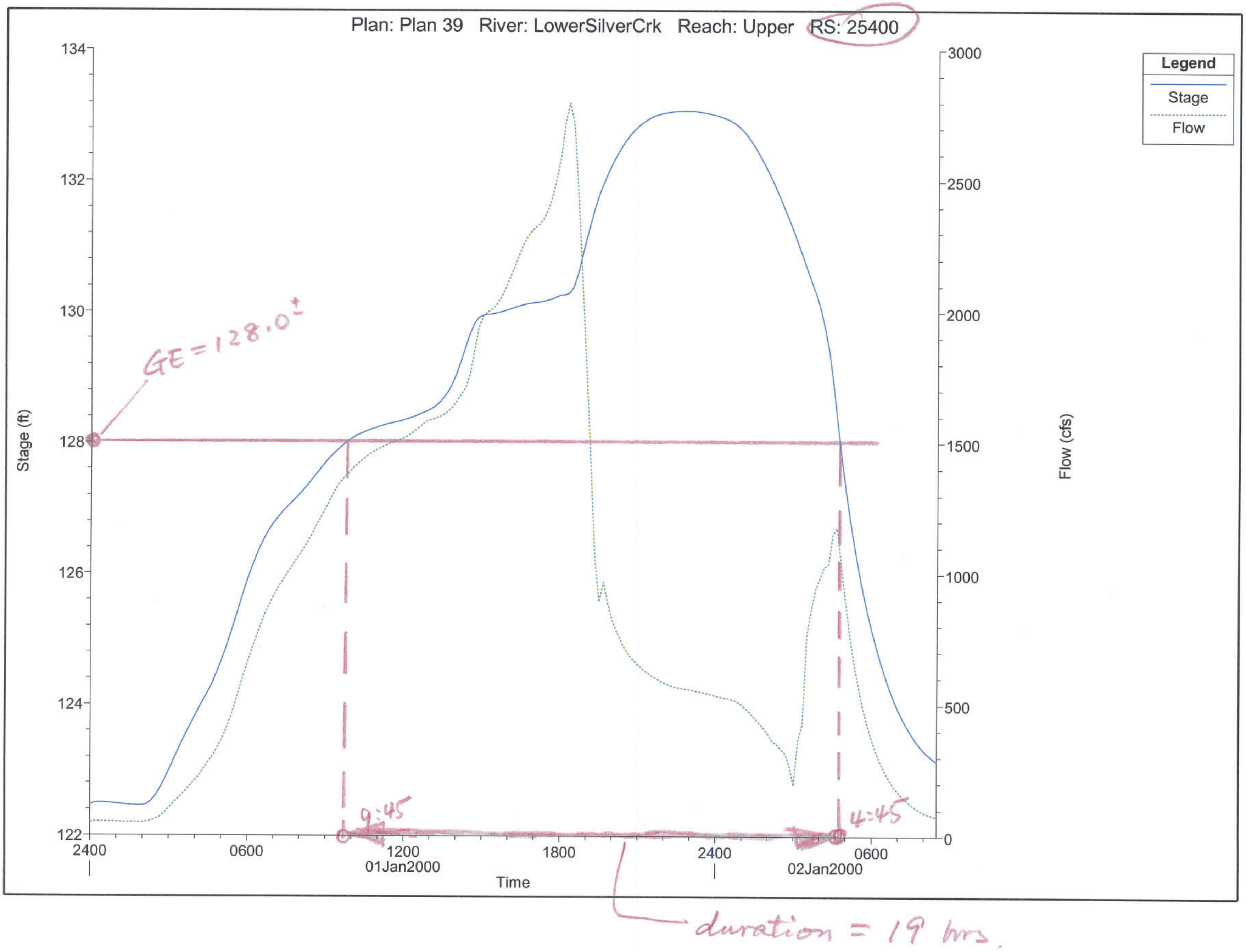
COMPACTION TEST REPORT

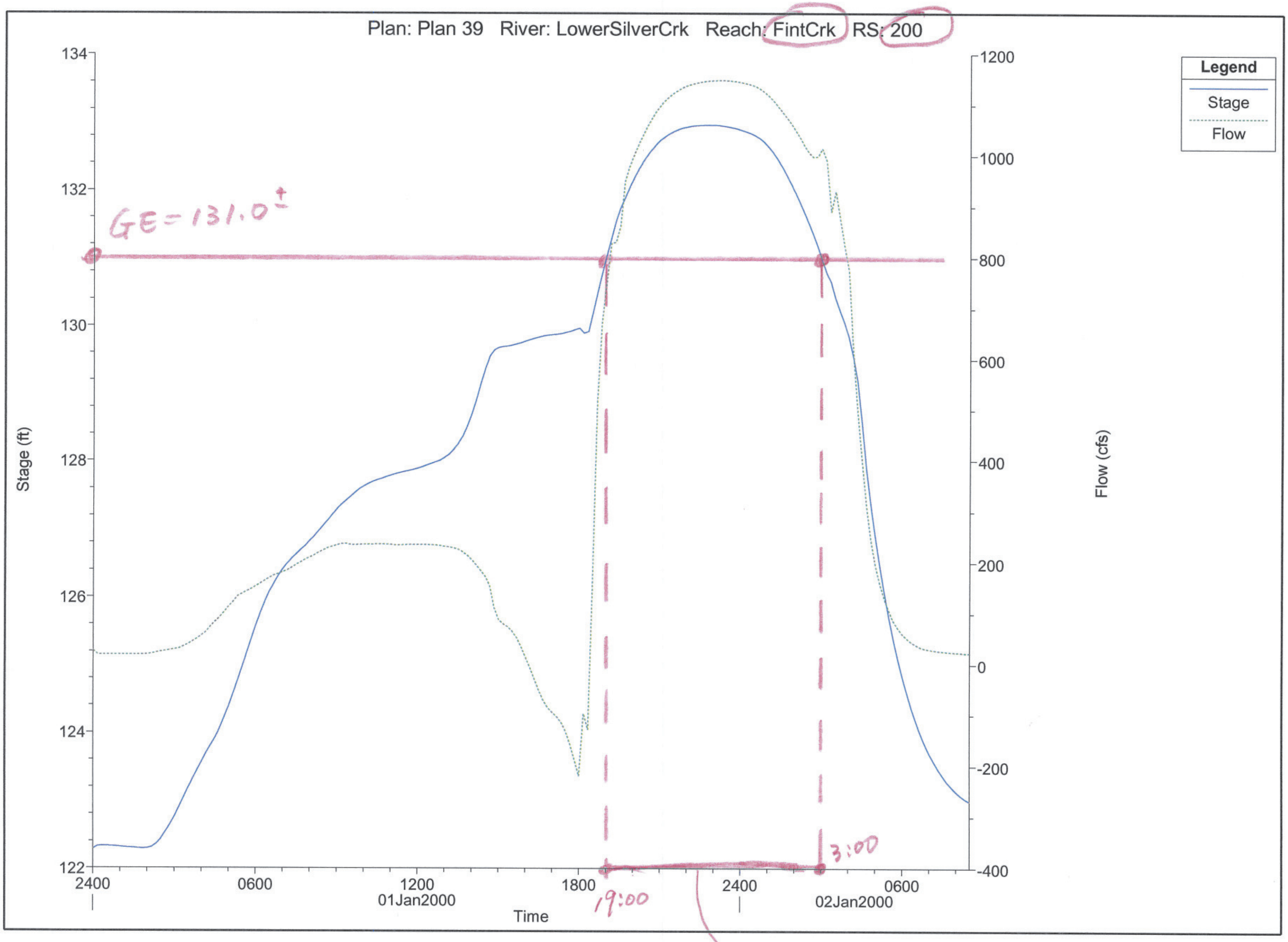
COOPER TESTING LABORATORY

Figure

APPENDIX C

HYDROGRAPHS FOR TRANSIENT SEEPAGE ANALYSES


Plan: Plan 39 River: LowerSilverCrk Reach: Upper RS: 25400
Legend
Stage
Flow
Stage (ft)
134
132
130
128
126
124
122
Flow (cfs)
3000
2500
2000
1500
1000
500
0
Time
2400
0600
1200
01Jan2000
1800
2400
0600
02Jan2000
GE = 128.0±
9:45
4:45
duration = 19 hrs.



Plan: Plan 39 River: LowerSilverCrk Reach: FintCrk RS: 200

duration = 8 hrs